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SUMMARY

The primary purpose of this econometric study is to assess U.S. experience with export restraint agreements (ERA's) as a remedy for import-caused injury. 1/ The study examines the effects of restraints imposed by foreign countries on their own exports of steel, color television receivers, and nonrubber footwear to the United States. It estimates the effects of these agreements on the quantities of U.S. imports as well as on domestic prices, demand, production, and employment.

The key element of an export restraint is an export quota. Quotas are generally prohibited under the international trade rules of the General Agreement on Tariffs and Trade (GATT) to which most of the world's large trading countries subscribe. Export restraint agreements, however, are generally considered to be outside the scope of the GATT. These agreements are "voluntary," although the exporting country taking such "voluntary" action generally does so as a result of pressure from the importing country and in response to the prospect of more restrictive action on the part of the importing country.

The ERA's discussed in this report were sought by the United States in order to reduce the impact of imports on certain U.S. industries. The steel ERA's were called voluntary restraint arrangements; there were no written agreements. The television and footwear ERA's were Orderly Marketing Agreements negotiated by the President pursuant to section 203 of the Trade Act of 1974.

The Estimated Effects

This study used two estimating techniques: the multiple regression analysis and the input-output approach. Three statistical (regression) models of the industries were developed for the purpose of estimating the effects of the ERA's on the levels of imports, domestic prices, demand, and production. 2/ The effects on domestic employment were estimated by the input-output approach. All estimated effects of the agreements are summarized in the following paragraphs.

The steel industry

The United States negotiated voluntary restraint arrangements (VRA's) on steel mill products with Japan and the European Economic Community in late 1968. The VRA's, which went into effect on January 1, 1969, for a 3-year period, were extended thereafter for an additional 3-year period. The arrangements had a sizable effect on the U.S. industry during the 6-year period 1969-74.

1/ This is one of a series of Commission studies which examined, through various techniques, the effects of different kinds of import relief. See for example The Effectiveness of the Escape Clause in Promoting Adjustment to Import Competition, Inv. No. 332-115, USITC Publication 1229, March 1982.

2/ Dependability of the estimates of the effects varied by equations and variables included in the three statistical models. This study used the F statistic and t ratio to measure dependabilities of the estimates, as shown in apps. B, C, and D.

Effects on imports.--During the 6-year period, the estimated reduction each year in the volume of steel imports attributable to the VRA's was large, ranging from 6.5 percent in 1973 to 32.8 percent of the actual imports in 1970. Over the whole period, the VRA's were estimated to have reduced imports by 19.04 million net tons, which were valued at $6.10 billion in 1974 dollars. As a result of the upgrading of the product mix of steel exports by the restraining countries, the VRA's were relatively less effective in restraining the value of imports. Other factors also influenced imports during the years under the VRA's, including exchange rate fluctuations, domestic price controls, and changes in world demand for steel.

Effects on domestic prices and demand.--The imposition of the VRA's resulted in increases in the annual average producer price of steel mill products, estimated to range from $2.84 per net ton in 1973 to $11.83 per net ton in 1970. For the 6-year period, the average price of steel mill products would have been an estimated 3.8 percent lower if the VRA's had not been imposed. In addition to the VRA's, steel prices were also influenced by world and U.S. market conditions, increased energy and other production costs, and domestic price controls. Because prices were higher under the VRA's than they otherwise would have been, the quantity of steel demanded was reduced from what it would have been. The estimated effects of the VRA's on the quantity demanded ranged from a decrease of 0.59 million net tons in 1973 to a decrease of 2.82 million net tons in 1970. In total, the VRA's were estimated to have lowered the quantity demanded, because of the price increases, by 11 million net tons over the 6-year period.

Effects on domestic production and employment.--Although the VRA's reduced the volume of steel imports considerably, they had a relatively small effect on domestic production. For instance, although domestic production increased by 21 percent in 1973 compared with the 1972 production level, only 1.1 percent, or 250,000 net tons, of the 1973 increase was attributed to the VRA's according to the statistical model of the steel industry. Most of the fluctuation in production during the period was attributable to fluctuations in world market conditions. Estimated increases in steel production attributable to the VRA's ranged from 0.14 million net tons in 1969 to 4.79 million net tons in 1971. In total, the VRA's increased domestic production an estimated 9.7 million net tons over the 6-year period. The estimated increase was valued at $2.79 billion in 1974 dollars. The actual cumulative increase in production over the period was 33.3 million net tons. About 29 percent was accounted for by the VRA's.

This study also investigated the effects of the VRA's on total domestic employment, including that in the steel and related industries, using input-output coefficients to convert production changes to employment changes. The estimated annual effects on domestic employment ranged from an increase of 1,657 man-years in 1969 to an increase of 55,223 man-years in 1971. On the average, the VRA's saved 19,117 jobs per year in the 6-year period.

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The color television receiver industry

In May 1977, the President negotiated a 3-year orderly marketing agreement (OMA) with the Government of Japan, which became effective on July 1, 1977, limiting exports of color television receivers and certain of their subassemblies from Japan to the United States. During the period of the agreement, the Republic of Korea (Korea) and Taiwan, which had not entered into agreements, increased their exports to the U.S. market. After the Japanese Government complained of such increased imports from Taiwan and Korea, the U.S. Government negotiated OMA's with Korea and Taiwan. These agreements were initially in effect from February 1, 1979, to June 30, 1980, the balance of the period covered by the OMA with Japan.

The President subsequently extended the OMA's with Korea and Taiwan from July 1, 1980, to June 30, 1982, but allowed the OMA with Japan to terminate on June 30, 1980, as scheduled, because imports from Japan had been at levels significantly below those permitted by the OMA. Accordingly, the following estimates were limited to a 3-year, or 12-quarter, period covering July 1977 through June 1980.

Effects on imports.--The estimated yearly effects of the OMA's on the quantity of imports of color television receivers for the 3-year period ranged from a decrease of 147,900 sets in the third OMA year to a decrease of 621,300 sets in the second OMA year. During the period, U.S. imports of color television sets would have increased by an estimated 1,113,300 units in the absence of the OMA's. The total estimated decrease in the imports was valued at $267 million in 1980 dollars. The large reduction in imports of Japanese color sets in the third year of the OMA's was caused by other factors as well. One that might have contributed to the reduction was the substantial increase in the capacity and levels of production of Japanese-owned firms in the United States. Apparently, the increased production by these firms was used to replace imports from Japan.

Effects on domestic prices and demand.--Estimates of the increases in the annual average producer price of color television receivers attributable to the OMA's ranged from 0.37 percent to 4.07 percent, or from $1.29 per set in the first OMA year to $14.30 per set in the third OMA year. It was estimated that the OMA's pushed up the average domestic price by an estimated 1.63 percent. Since the OMA's resulted in increased domestic prices, they also decreased the quantity of color television sets sold. Estimated effects of the OMA's on the quantity sold ranged from a decrease of 7,847 sets in the first OMA year to a decrease of 73,725 sets in the third OMA year. In total, the OMA's reduced the quantity demanded by an estimated 150,489 units over the 3-year period.

Effects on domestic production and employment.--The reductions in the levels of imports and quantity demanded affected domestic production. The estimates of the effects of the OMA's on domestic production ranged from an increase of 74,175 units in the third OMA year to an increase of 552,365

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units in the second OMA year. For the 3-year period, domestic production would have been an estimated 962,811 units less in the absence of the OMA's. The estimated change in domestic production was valued at $338 million in 1980 dollars.

By using input-output coefficients, estimates of the effects of OMA's on domestic employment were derived from the estimated changes in domestic production. The estimates of increases in employment attributable to the OMA's ranged from 992 man-years in the third OMA year to 8,035 man-years in the second OMA year. In the absence of the OMA's, it was estimated that the domestic color television receiver and related industries would have employed 4,755 fewer workers, on average, over the 3-year period.

Another possible effect of the OMA's is related to foreign investments in the United States. During the OMA period, five additional foreign firms built color television assembly facilities in the United States and produced sets here. There were only four such foreign firms in the United States prior to implementation of the OMA's. Therefore, it is likely that the OMA's accelerated direct foreign investments in the U.S. color television receiver industry.

The nonrubber footwear industry

After receiving the Commission's report on the investigation on nonrubber footwear in March 1977, the President decided to negotiate orderly marketing agreements on nonrubber footwear with Korea and Taiwan. The OMA's with these two countries were in effect for 4 years, from June 28, 1977, through June 30, 1981. They were not extended beyond the original period. Estimates of the effects of the OMA's were limited to the 3-year period 1977-79.

Effects on imports.--Although the two OMA's limited the volume of U.S. imports of nonrubber footwear from the restraining countries, the quantitative restraints were largely offset by increases in imports from nonrestraining countries. Estimates of reduction each year in the level of footwear imports attributable to OMA's ranged from 6.12 percent in 1979 to 8.65 percent in 1977. It was estimated that, in the absence of the OMA's, the total quantity of imports would have averaged 29.3 million pairs per year higher over the 3-year period. The total estimated reduction in the imports attributable to the OMA's was valued at $527 million in 1979 dollars.

Effects on domestic prices and demand.--Estimated increases in the annual average producer price of nonrubber footwear caused by the export restraints ranged from 0.47 percent to 10.05 percent, or from $0.04 per pair in 1977 to $1.07 per pair in 1979. It was estimated that, on the average, the OMA's pushed up the price of nonrubber footwear by 3.9 percent per year. The increase in domestic prices was associated with changes in the quantity of footwear demanded. The estimated annual effects of the OMA's on the quantity demanded ranged from a decrease of 440,093 pairs in 1977 to a decrease of 9,573,229 pairs in 1979. The total reduction in domestic consumption due to the OMA's for the 3 years was 11,068,000 pairs.

Effects on domestic production and employment.--Estimates of the effects of the OMA's on domestic production were determined by changes in domestic demand and the level of imports. The estimated annual effects on domestic production ranged from an increase of 15.2 million pairs in 1979 to an increase of 31.4 million pairs in 1977. It was estimated that domestic production would have been 76.9 million pairs less in the absence of the OMA's. The estimated change in domestic production was valued at $815 million in 1979 dollars. The domestic nonrubber footwear and related industries would have employed 15,099 fewer workers per year, on average, from 1977 to 1979, in the absence of the agreements.

CHAPTER 1. INTRODUCTION

The subject of this paper is a relatively new way to limit imports: export restraint agreements (ERA's). 1/ These differ from traditional forms of protection in several ways. First, they are imposed by the exporting country or countries, whereas traditional tariffs and quotas are imposed by the importing country or countries.

Second, ERA's generally apply only to exports to certain countries. Thus, they differ from restrictions covered under article I of the General Agreement on Tariffs and Trade, the most-favored-nation (MFN) principle, since they do not generally apply equally to all MFN trading partners.

Third, ERA's are export, rather than import, quotas. That is to say, they are administered by the exporting country, although the importing country may also establish an import quota to insure that imports from the exporting country do not exceed the agreed limit.

Lastly, ERA's are "voluntarily" entered into by the exporting country, although the exporting country generally takes such action to forestall the importing country from taking more drastic unilateral action.

There is no precise definition of an ERA. ERA's have been known as self-restraint arrangements (SRA's), market penetration constraints (MPC's), voluntary export restraints (VER's), voluntary restraint agreements (VRA's), voluntary restraint arrangements (VRA's) and orderly marketing agreements (OMA's). While ERA's always contain an export quota, they follow no prescribed format. The export quota may be only one element of the agreement. There may be other provisions of the agreement regulating exports from the exporting country or providing for review of or changes in the quota under certain circumstances. ERA's need not be in writing, and when not in writing they are frequently referred to as arrangements rather than agreements. Their full terms may not be publicly known. They are not necessarily the result of negotiations in which the importing country has actively participated (in fact, the domestic laws of the importing country may prohibit such participation). Finally, they may be bilateral in the sense that the importing country may impose a corresponding import quota.

The term "orderly marketing agreement" is generally used to describe export restraint agreements specifically authorized by U.S. legislation. Section 203 of the Trade Act of 1974 (19 U.S.C. 2253), which describes the types of relief the President can impose when this Commission has made an affirmative determination under section 201 of the Act, 2/ permits the

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1/ The first four export restraint agreements were reached between Japan and the United States in the mid-1930's; they limited Japanese exports of various cotton textiles to the United States for a period of no more than 3 years.

2/ In order to make an affirmative determination, the Commission must find that "an article is being imported into the United States in such increased quantities as to be a substantial cause of serious injury, or threat thereof, to the domestic industry producing an article like or directly competitive with the imported article." This standard for relief is derived from the internationally-sanctioned rule under Article XIX of the GATT.

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President, among other things, to negotiate orderly marketing agreements with the countries exporting the product found to be injuring a U.S. industry. 1/ As a result of such an agreement, the exporting country would "voluntarily" limit its exports to the United States to a stated level over an agreed upon period, and to ensure that U.S. imports would not exceed the agreed upon level. The President would generally proclaim an import quota at the level set forth in the agreement. Other Presidential authority for negotiating orderly marketing agreements is set forth in section 204 of the Agricultural Act of 1956 (7 U.S.C. 1854), but that authority is limited to textile and agricultural products.

The ERA's discussed in this report were sought by the United States in order to reduce the impact of imports on certain U.S. industries. The steel ERA's were voluntary restraint arrangements; there were no written agreements. The television and footwear ERA's were orderly marketing agreements negotiated by the President pursuant to section 203 of the Trade Act of 1974.

Purpose of the Study

The purpose of this econometric study is to assess U.S. experience with export restraints as a means of limiting imports. More specifically, the study examines the effects of restraints imposed by foreign countries on their exports to the United States of steel, color television receivers, and nonrubber footwear as a result of agreements or arrangements negotiated by the United States. It evaluates the effects of these actions on the volume of U.S. imports, on the price of domestically produced competing products, and on levels of domestic consumption, production, and employment. The results are useful in appraising ERA's in terms of their cost and effectiveness in meeting their objectives. Whether the protected industries improved their competitiveness vis-a-vis foreign suppliers was not addressed in this study.

Contents of the Study

This study consists of five chapters and four appendices. The economic effects of voluntary export restraints in the industries producing steel, color television receivers, and nonrubber footwear are presented in chapters 2, 3, and 4, respectively. Chapter 5 contains the conclusions. Appendix A presents a theoretical framework for the analysis of trade restrictions. Appendices B, C, and D present in detailed form the statistical analyses used to derive the results stated in chapters 2, 3, and 4.

1/ The negotiation of an OMA is frequently a preferred approach to relief in section 201-203 matters since compensation (equivalent trade concessions to compensate for the increased protection of the article subject to the quota) to the exporting country would not be owed and the exporting country would have no right to retaliate. Were the United States to raise a tariff or impose a unilateral quota instead, compensation or retaliation might be permissible under the GATT. Exporting countries may prefer an OMA to other forms of relief because they may believe an OMA is likely to be less restrictive, that it can be more easily adjusted in the event problems are encountered in its administration, and/or that other GATT countries facing similar problems with respect to imports from the exporting country would be unsympathetic to any request for GATT action against the importing country.

CHAPTER 2. THE EFFECTS OF VOLUNTARY RESTRAINT ARRANGEMENTS ON STEEL MILL PRODUCTS

This chapter analyzes the effects of the voluntary restraint arrangements (VRA's) on steel mill products. 1/ The first section presents some background information on voluntary restraint arrangements in the U.S. steel industry. The second section presents the estimates of the effects of the VRA's on domestic prices, consumption, production, and employment as well as on the volume of U.S. imports of steel mill products. 2/ Comparisons between the estimated effects of this study and those of other studies are included in the second section. The statistical model of the steel industry used to calculate the economic effects of VRA's is presented in appendix B.

Background on Voluntary Restraint Arrangements on Steel Mill Products

Prior to the 1959 steel strike, imports of steel were insignificant, but beginning with the strike and continuing through the 1960's, imports of steel increased steadily. By late 1967, imports had grown to the point that there was congressional interest in establishing quotas on imports of iron and steel products. Senator Vance Hartke (D. Ind.) introduced a bill which, among other things, would have limited steel imports to 9.6 percent of the U.S. market, the share of the U.S. market held by imports during 1964-66. In the summer of 1968, both West Germany and Japan proposed to place voluntary restrictions on their steel exports to the United States in order to forestall the imposition of quotas. Their proposal was based on the condition that hearings on the quota bill be stopped and the bill be shelved. 3/ After a short period of negotiation, an agreement was reached in principle. 4/

The first two voluntary restraint arrangements on steel mill products took effect on January 1, 1969, and limited exports from Japan and the European Economic Community (EEC) to an amount of 5.75 million net tons each for 1969. 5/ Quotas were not established for specific products for individual exporting countries other than Japan. A 5-percent annual growth in the quotas was permitted. The arrangements were to expire on December 31, 1971.

Strong U.S. demand for imported steel during the restraint period coupled with the restraining effect of the quotas (e.g., the arrangement called for a reduction of imports from the subject countries in 1969 from 1968 levels) and the absence of limitations on specific types of steel products covered by the

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1/ The Trigger Price Mechanism is not covered by this study.

2/ For convenience, the price of domestically produced competing goods is referred as domestic price.

3/ W. T. Hogan, The 1970's: Critical Years for Steel, Lexington, Mass., 1972, pp. 54-55.

4/ At a press conference on July 10, 1968, Mr. Yoshihiro Inayama, chairman of the Japan Iron and Steel Exporters' Association, expressed Japan's readiness to voluntarily restrict exports to the United States. In the same capacity, he later sent an official statement to the U.S. Secretary of State on Dec. 23, 1968, indicating Japan's intention to restrain its exports to the United States. For details on the VRA's on steel imports, see Hogan, op. cit., pp. 45-71.

5/ Observed U.S. imports of steel from Japan and the EEC in 1968 were 7.3 million and 7.1 million net tons, respectively.

quotas resulted in a shift in product mix of imports towards more expensive stainless and alloy tool steel products. This occurred notwithstanding, for example, Japan's promise to "try not to change greatly the product mix and pattern of distribution of trade as compared with the present." 1/

The upgrading of imports can be shown by comparing the volume and the value of imports in 1968 and 1970. The total value of imports from the restraining countries was about the same, despite a 27-percent decline in the volume of imports in 1970. This implies that if the United States had imported the same quantities as in 1968 but with the product mix of 1970, the total value would have increased by 37 percent. Two factors accounted for the change in the value of the imports: the price of steel rose 14 percent from 1968 to 1970, and the product mix was upgraded. 2/

The trade statistics indicate that while the VRA's reduced the quantities of steel mill products imported, the arrangements were less effective in reducing the value of steel imports because of the changes in product mix. The 3-year extension of the arrangements (or the extended VRA's), which went into effect on January 1, 1972, contained specific tonnage limitations on categories of specialty steels such as stainless, tool, and other alloys, because of changes in product mix. Two types of steel, fabricated structural steel and cold bars, which Japan and the EEC claimed were excluded from the first VRA limitation, were specifically included. Instead of the former 5-percent rate, the extended arrangements set the annual increase in tonnage of allowable imports at 2.5 percent. 3/ Unlike the original VRA's, which gave the same export quota to Japan and the EEC, the extended VRA's set a higher quota for the EEC because the United Kingdom joined the EEC in 1972.

The export ceilings under these arrangements, and the actual U.S. imports from each group of countries for which the arrangements were in effect, are shown in table 2.1.

1/ This promise was stated in Inayama's letter to the U.S. Secretary of State dated Dec. 23, 1968.

2/ U.S. Department of Commerce statistics indicate that the composite price for finished steel rose from $0.0873 per pound in 1968 to $0.1014 in 1970. The total quantity and value of imported steel from the restraining countries in 1968 were 14.39 million net tons and $1,514 million, respectively. The 1970 figures were 10.50 million net tons and $1,510 million. Exports of steel to the United States by the United Kingdom were not included in the figures for either year.

3/ On May 2, 1972, the Associations of the Steel Producers of the European Coal and Steel Community and the Association of Steel Producers of the United Kingdom declared, through a letter addressed to the U.S. Secretary of State, their intention to limit exports of steel mill products to the United States through Dec. 31, 1974. On May 4, the Chairman of Japan Iron and Steel Exporters' Association wrote a letter to the U.S. Secretary of State for the same purpose. All terms of the renewed VRA's were stated in these two letters.

Table 2.1.--Export ceilings and actual U.S. imports of steel mill products, 1969-74

(In thousands of net tons)

Item	1969	1970	1971	1972	1973	1974
Japan:						
VRA ceiling	5,750	6,038	6,339	6,498	6,660	6,827
Actual U.S. imports	6,253	5,935	6,908	6,440	5,637	6,159
Actual imports as percentage of ceiling	108.7	98.3	109.0	99.1	84.6	90.2
EEC: 1/						
VRA ceiling	5,750	6,038	6,339	8,014	8,094	8,296
Actual U.S. imports	5,199	4,573	7,156	7,779	6,510	6,424
Actual imports as percentage of ceiling	90.4	75.8	112.9	97.0	80.4	77.4
All restraining countries:						
VRA ceiling	11,500	12,075	12,679	14,512	14,754	15,123
Actual U.S. imports	11,452	10,508	14,064	14,219	12,147	12,583
Actual imports as percentage of ceiling	99.6	87.0	110.9	98.0	82.3	83.2
Nonrestraining countries:						
Actual U.S. imports	2,582	2,856	4,240	3,462	3,003	3,387
Total U.S. imports	14,034	13,364	18,304	17,681	15,150	15,970
Exports of nonrestraining sources as percentage of U.S. imports	18.4	21.4	23.2	19.6	19.8	21.2

1/ United Kingdom excluded in 1969-71 and included in 1972-74.

Source: U.S. Department of Commerce and letters of intent of Japanese and European steel producers.

The Estimated Effects of the VRA's on Steel Mill Products

For the purpose of estimating the effects of the VRA's on steel mill products, this study assumes that, because there is a high degree of concentration in the industry, there is also a high degree of interdependence among firms: the actions of each firm can affect all others in the steel market. As a result, each firm is assumed to have a good idea of what the reactions of its competitors and customers would be to a price change. Calculations of the effects of the VRA's are based on a market model, whose specifications are shown in appendix B. Substitutions of imports from the nonrestraining countries for imports from the restraining countries are considered in the model.

As shown in table 2.1, the observed quantity of U.S. imports from the restraining countries was at or below the announced ceiling in 5 of the 6 years; it exceeded the ceiling in 1971. Two things contributed to the overshipments in 1971: the excess capacity of restraining countries, which was then the highest of all 6 years the VRA's were in effect, and a 10-percent import surcharge imposed by the United States on August 15, 1971. Once the surcharge was imposed, the restraining countries no longer felt obligated to abide by the arrangements. 1/

Table 2.1 also shows that the lowest ratio of the actual exports to the quota ceiling, 82.3 percent, was in 1973. The high domestic shipments in the restraining countries and their relatively low rates of excess capacity were two possible explanations for the low ratio. U.S. domestic shipments also peaked in 1973; the high level was fostered by an improvement in the competitiveness of U.S.-produced steel, which was brought about by a devaluation of the dollar. 2/ The observation that the actual levels of exports were below the quota limits should not be interpreted to mean that the export quotas were set above free-market levels. 3/ Several studies, including this one, indicate that imports would have been greater if they had not been discouraged by the quotas. The economic effects of the VRA's estimated by this study are shown in table 2.2.

1/ Hogan, op. cit., p. 62.

2/ The capacity utilization rate in the U.S. steel industry reached its peak, 98 percent, in 1973. A General Accounting Office study indicated that the shift in competitiveness of U.S. steel was brought about by devaluation of the dollar, which made U.S. steel prices more attractive, and by the worldwide boom in steel demand. For details, see The Comptroller General of the United States, Economic and Foreign Policy Effects of Voluntary Restraint Agreements on Textiles and Steel, March 1974.

The domestic steel industry's competitiveness problems were also discussed comprehensively in an Office of Technology Assessment Report entitled Technology and Steel Industry Competitiveness, U.S. Congress, June 1980.

3/ World demand was extremely high and prices in Europe and some nonrestraining countries were higher than in the United States in 1973; thus it was not a bargain to export to the United States.

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Table 2.2.—Estimated effects of the VRA's on steel mill products, 1969-74

Item	1969	1970	1971	1972	1973	1974
Changes in imports:						
Million net tons	-2.85	-4.39	-5.24	-1.51	-0.98	-4.07
Percent of observed imports	20.3	32.8	28.6	8.5	6.5	25.5
Changes in domestic price:						
Per net ton	$9.67	$11.83	$11.03	$3.85	$2.84	$10.43
Percent of observed price	5.3	5.7	5.3	1.7	1.3	3.6
Changes in domestic demand:						
Million net tons	-2.42	-2.82	-2.50	-0.82	-0.59	-1.86
Percent of observed demand	2.4	2.9	2.4	0.8	0.5	1.6
Changes in domestic production:						
Million net tons	0.14	1.54	4.79	0.80	0.25	2.12
Percent of observed production	0.1	1.7	5.5	0.9	0.22	1.9
Changes in domestic employment: 1/						
Man-years	1,657	17,335	55,223	9,394	2,857	28,235
Calculated exports of restraining countries under free trade:						
Million net tons	13.99	15.22	19.51	15.76	12.98	16.75
Observed exports of restraining countries:						
Million net tons	11.50	10.51	14.06	14.22	12.15	12.58
Announced export quota ceilings:						
Million net tons	11.50	12.08	12.68	14.51	14.75	15.12

(millions of net tons)

1/ Changes in domestic employment include those of related industries such as iron ore mining, coal mining, limestone, and scrap.

Source: App. B.

Effects on imports

The estimated annual reductions in the volume of steel imports due to the VRA's were large, ranging from 6.5 percent of the actual imports in 1973 to 32.8 percent in 1970. Over the 6-year period, the VRA's reduced the imports by an estimated 19.04 million net tons, with an annual average reduction of 3.2 million net tons. 1/

Jondrow 2/ and Takacs 3/ also evaluated the VRA's effects on the U.S. steel industry. One major difference between their studies is the substitution assumptions. Takacs permits import substitution between restraining and nonrestraining countries, and Jondrow assumes that quantitative restrictions are applicable to all exporting countries. 4/ Their estimates of the effects of the VRA's on the volume of imports of steel mill products are larger than those of this study, as indicated in table 2.3. 5/

The effects of the VRA's on the volume of imports can also be calculated using estimates of the responsiveness of imports to income (GNP) and price changes. For instance, MacPhee used an estimated income elasticity of demand for steel imports of 2.3 (i.e., degree of responsiveness of steel imports to income) to predict what U.S. imports of steel would have been at constant relative prices. With a 2.6-percent increase in real gross national product (GNP) in 1969, he estimated that the volume of U.S. steel imports in 1969 should have increased by 6.0 percent to 18.8 million net tons. The actual import volume was 14.0 million net tons, indicating that the VRA's effect on U.S. steel imports in 1969 prevented the entry of 4.8 million net tons. 6/ This figure is higher than the estimates by Jondrow and this study, but lower than Takacs' estimate.

Effects on domestic producer prices

The model indicates that the imposition of VRA's on steel mill products resulted in increased domestic prices. The estimated increases in the annual average producer price of steel mill products ranged from 1.3 percent in 1973 to 5.7 percent in 1970. Average estimate for the 6 years shows that VRA's caused users to pay 3.8 percent more than under free trade.

In his study, Jondrow simply assumed that producer prices of steel were unaffected by imports. His assumption is contradicted by the results of Crandall, who regressed the producer prices on the prices of imported steel

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1/ The total reduction in imports was valued at $6.10 billion based on the unit value (f.o.b.) of U.S. imports of steel mill products in 1974.

2/ A. Jondrow, "Effects of Trade Restrictions on Imports of Steel," in U.S. Department of Labor, The Impact of International Trade and Investment on Employment, 1978.

3/ W. E. Takacs, Quantitative Restrictions and U.S. Steel Industry, an unpublished Ph.D. dissertation, Johns Hopkins University, May 1975.

4/ Takacs' assumption corresponds to the two-exporter model shown in fig. A.4, while Jondrow's assumption corresponds to the single-exporter model shown in fig. A.3 in app. A of this study.

5/ Jondrow's study covered only 5 years, 1969-73.

6/ R. A. MacPhee, Restrictions on International Trade in Steel, Lexington, Mass., 1974. MacPhee's extrapolating method was used in subsequent cases of color television receivers and nonrubber footwear of this study.

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Table 2.3.--A comparison of different estimates of the effects of the VRA's on the volume of imports of steel mill products, 1969-74

(In millions of net tons)

Item	1969	1970	1971	1972	1973	1974	Annual average
This study--	-2.85	-4.39	-5.24	-1.51	-0.98	-4.07	-3.2
Jondrow------	-3.30	-4.10	-9.20	-10.20	-7.20	-	-6.8
Takacs-------	-5.81	-7.96	-10.91	-8.44	-7.74	-12.92	-9.0
MacPhee 1/--	-4.80	-	-	-	-	-	-

1/ MacPhee estimated the change in imports for 1969 only.

and other variables. Crandall's estimates of the effects of the VRA's on the producer price are within a range of 1.2 percent in 1971 to 3.5 percent in 1972. 1/ Takacs' estimated changes in the prices are much higher, ranging from 13 percent in 1972 to 15 percent in 1971.

This study's estimates of changes in domestic prices fall between the estimates of Crandall and Takacs, with estimated effects on domestic prices ranging from a 1.3-percent increase in 1973 to a 5.7-percent increase in 1970. As expected, the empirical results of the three studies are consistent with the hypothesis that the restraints have a positive effect on the domestic price. A comparison between this study and Takacs' estimates of the VRA's effects on the domestic producer price is presented in the following table.

Table 2.4.--A comparison of different estimates of the effects of the VRA's on domestic prices of steel mill products, 1969-74

(per ton)

Item	1969	1970	1971	1972	1973	1974	Annual average
This study--	$9.67	$11.83	$11.03	$3.85	$2.84	$10.43	$8.28
Takacs-------	$26.14	$29.65	$32.07	$27.88	$28.56	$38.95	$30.58

Effects on domestic demand

Increases in the domestic price of steel mill products were expected to decrease the quantity demanded, as the law of demand states that the price and quantity demanded are inversely related. The largest increase

1/ R. A. Crandall, The United States Steel Industry in Recurrent Crisis: Policy Options in a Competitive World, The Brookings Institution, 1981. Crandall's study is limited to basic carbon steel, which is disaggregated into five major categories: bars, cold-rolled sheet, hot-rolled sheet, plate, and structurals. Like this study, Jondow's and Takacs' studies cover all types of steel mill products without disaggregation.

in the domestic price, in 1970, was estimated to have resulted in the largest decrease in the quantity of steel mill products demanded (2.82 million net tons). The smallest estimated decline in the quantity demanded was found in 1973, when the estimated increase in domestic price was the smallest during the 6-year period. In total, the estimated reduction in the quantity demanded was 11.01 million net tons, which was smaller than Takacs' estimates. The following table is a comparison of the estimates of the two studies.

Table 2.5.--A comparison of different estimates of the effects of the VRA's on domestic demand for steel mill products, 1969-74

(In millions of net tons)

Item	1969	1970	1971	1972	1973	1974	Annual average
This study--	-2.42	-2.82	-2.50	-0.82	-0.59	-1.86	-1.84
Takacs-------	-6.03	-6.84	-7.39	-6.43	-6.59	-8.98	-7.04

Takacs' estimated changes in domestic demand are relatively large, which is not surprising because her estimated changes in domestic prices are larger than those of this study.

Effects on domestic production and employment

Although the VRA's may have reduced the volume of steel imports from VRA countries considerably, they apparently had a relatively small effect on domestic production. For instance, in 1973, when domestic production increased by 21 percent compared with the 1972 production level, according to the statistical analysis only 1.1 percent of the increase, or 250,000 net tons, could be attributed to the VRA's. Most of the increase in domestic productions was attributable to increased demand for steel. This study found that the largest effect of the VRA's on domestic production was an increase of 4.79 million net tons in 1971.

Jondrow's study found a relatively large effect on domestic production compared with Takacs' study and this study. However, unlike the Takacs' study and this study, Jondrow's study did not take into account imports from third countries. A comparison of the effects of the VRA's on domestic production estimated by the three studies is presented in the following table.

Table 2.6.--A comparison of different estimates of the effects of the VRA's on domestic steel production, 1969-74

(In millions of net tons)

Item	1969	1970	1971	1972	1973	1974	Annual average
This study--	0.14	1.54	4.79	0.80	0.25	2.12	1.61
Jondrow------	1.50	2.87	6.00	7.70	7.84	--	5.18
Takacs-------	-0.22	1.22	3.52	2.01	1.16	3.94	1.94

All three studies indicate that domestic steel production would have been lower in the absence of the VRA's, and, thus, employment in the steel industry would have been lower also.

This study also estimated the effects of VRA's on total domestic employment, including that in the steel and related industries. An input-output technique was used to convert production changes into employment changes. The calculated annual effects on employment ranged from 1,657 man-years to 55,223 man-years. On the average, the VRA's were estimated to have saved 19,117 jobs per year over the 6-year period. 1/

Jondrow also estimated the effect of the VRA's on employment in the steel industry (SIC sector 331) during the restraining period, 1969-73. His results, as well as those of this study, are presented in the following table.

Table 2.7.--A comparison of different estimates of the effects of the VRA's on domestic employment, 1969-74

(In man-years)

Item	1969	1970	1971	1972	1973	1974	Annual average
This study--	1,657	17,335	55,223	9,394	2,857	28,235	19,117
Jondrow-----	16,495	38,961	34,051	89,997	109,341	-	57,769

Jondrow's estimates of changes in domestic employment are higher than those of this study because his estimates of the production effects are much higher. The method of estimating the employment effects differed in that Jondrow failed to account for employment effects in related industries. This study was unable to adjust for the fact that the least efficient facilities would have been the ones that would have been closed if production dropped. Therefore, using average employment per unit of output might underestimate the employment effects slightly in this study.

Although the four empirical studies (Crandall, Jondrow, Takacs, and this study) resulted in different magnitudes of the effects of the VRA's on steel imports, they all reached the same conclusion that the VRA's reduced the volume of U.S. steel imports. Thus, it can be concluded that in terms of restricting the total volume of steel imports, the VRA's served their purpose. However, they were relatively less effective in restraining the

1/ The direct and the indirect labor requirements for I-O sector 37, "Primary iron and steel products," of the input-output table published by the U.S. Department of Commerce, February 1974, were calculated. Capital and labor requirements for all U.S. industries were included in table 4.4 of "Factor Endowments, Foreign Trade and Economic Development," a paper presented at the 1979 American Economic Association Convention, Atlanta, Ga., Dec. 29, 1979, by J. T. H. Tsao.

value of imports due to the upgrading in the mix of steel exports by restraining countries. The VRA's might have been more restrictive if the agreed-to export quotas had been defined in terms of both volume and value. 1/

1/In his paper entitled Effects of Nontariff Barriers to Trade on Prices, Employment, and Imports: The Case of the Swedish Textile and Clothing Industry, C. Hamilton indicated that export quotas can be defined in volume and/or value terms. For state trading countries, quotas are always defined in value terms but adjusted for inflation from one year to another. His paper was published in December 1980 by the World Bank as its staff working paper No. 429.

CHAPTER 3. THE EFFECTS OF ORDERLY MARKETING AGREEMENTS ON COLOR TELEVISION RECEIVERS

This chapter analyzes the effects of the orderly marketing agreements in the color television receiver industry. The first section presents background information on these agreements. The second section contains the estimated effects of the OMA's on domestic average prices, demand, production, and employment, as well as on the volume of U.S. imports of color television receivers. 1/ The statistical model and data used to estimate the effects of the OMA's are included in appendix C.

Background on Orderly Marketing Agreements on Color Television Receivers

In 1960, just as mass production of color sets was starting in the United States, RCA licensed color technology to the Japanese. At that time, intense competition from Japan was not anticipated. 2/ However, within a few years after acquiring the technology, Japanese producers started to export color sets to the United States and other countries. In the mid-1960's, U.S. imports of color sets from Japan increased substantially, from 33,000 units in 1965 to 613,000 units in 1968.

In response to this rapid increase in imports, the first legal action against foreign television receiver suppliers, an antidumping complaint, was filed by the Electronic Industries Association in 1968. The complaint alleged that monochrome and color television sets from Japan were being sold in the United States at less than fair value (LTFV). In late 1970 the Secretary of the Treasury found that there were such LTFV sales and on March 4, 1971, the Tariff Commission (now the U.S. International Trade Commission) notified the Secretary of the Treasury that such LTFV sales were injuring the U.S. industry. The Treasury thereupon issued a dumping finding and final appraisal on all future subject imports was held pending a transaction-by-transaction review to determine whether the transaction was at a less-than-fair-value price. 3/ A dumping duty was to be assessed in an amount equal to the difference between fair market value and less than fair market value price. The assessment of dumping duties has not been terminated, and LTFV imports from Japan continue to be subject to dumping duties.

On June 8, 1971, the U.S. Tariff Commission instituted an escape-clause investigation (No. TEA-I-21) under section 301(b) of the Trade Expansion Act of 1962 upon petition by three major unions. The petitioners alleged that imports of television receivers had seriously injured the U.S. industry. The Commission made a negative determination in that case.

1/ This study is of complete color television receivers only. Unless otherwise stated, all references to color television receivers or television sets mean complete color television sets.

2/ U.S. Department of Commerce, The U.S. Consumer Electronics Industry and Foreign Competition, May 1980, p. 14.

3/ For details of the investigation see Television Receiving Sets From Japan: . . . Investigation No. AA1921-66 . . ., TC Publication 367, March 1971.

In 1976, a group of labor unions and six U.S. firms, producing television receivers and/or parts thereof, petitioned the Commission for import relief under section 201 of the Trade Act of 1974, the so-called escape-clause provision. 1/

On the basis of its investigation, the Commission found that assembled or nonassembled, finished or not finished, color television receivers, provided for in item 685.20 of the Tariff Schedules of the United States (TSUS), were being imported into the United States in such increased quantities as to be a substantial cause of serious injury to the domestic industry producing articles like or directly competitive with the imported articles. 2/ Subsequently, in May 1977, the President negotiated a 3-year OMA with the Government of Japan, which became effective on July 1, 1977, limiting exports of color television receivers and certain of their subassemblies from Japan to the United States. 3/

The OMA called for the Government of Japan to limit its exports of complete and incomplete color television receivers to the U.S. market to 1.75 million units, including 1.56 million complete sets. This was considerably less than the 2.53 million complete sets Japan exported to the United States in 1976.

In the first restraint year (July 1, 1977-June 30, 1978), imports from Japan were 1.6 million sets. However, in the second restraint year (July 1, 1978-June 30, 1979), actual Japanese exports of complete sets declined to only 952,396 units, or 59.3 percent of the agreed restraint level. This ratio declined further to 24.5 percent in the third restraint year.

While the Japanese restrained their exports to the United States, Korea and Taiwan increased their production and exports to the United States. U.S. imports of color sets from Taiwan almost doubled, rising from 321,941 units in 1977 to 624,456 units in 1978. In the same period U.S. imports of color sets from Korea more than quadrupled, increasing from 96,474 units to 436,885 units. Due to increases in imports from the nonrestraining countries, total U.S. imports increased from 2,538,696 units in 1977 to 2,774,856 units in 1978. The Government of Japan complained of these increases, and referred to the provisions of the OMA. In response to this increase in imports and the Japanese complaint, the U.S. Government negotiated OMA's with Korea and Taiwan in December 1978 to be in force from February 1, 1979, to June 30, 1980. 4/

1/ So-called because sec. 201 sets forth the procedures through which an industry or other appropriate requesting party may seek higher duties or quotas through the United States' invoking of Article XIX of the GATT, which allows a country to "escape" from its trade commitments in certain circumstances. Not all actions resulting from a sec. 201 proceeding require the invoking of the escape clause. For example, OMA's do not.

2/ Television Receivers, Color and Monochrome, Assembled or not Assembled, Finished or not Finished, and Subassemblies Thereof: Report to the President on Investigation No. TA-201-19 . . . , USITC Publication 808, March 1977.

3/ For a complete description of OMA's with Japan, Korea, and Taiwan, see Television Receiving Sets From Japan: Determination of the Commission in Investigation No. 751-TA-2 . . ., USITC Publication 1153, June 1981.

4/ The OMA with Korea did not differentiate between complete and incomplete color television receivers, but the OMA with Taiwan did.

On May 16, 1980, shortly before the OMA's were to expire, the Commission, pursuant to section 203 of the Trade Act of 1974, submitted a report to the President advising that termination of the import relief presently in effect with respect to color television receivers from Taiwan and Korea would have an adverse impact on the domestic industry producing such articles and should therefore be extended. The report also said that termination of the import relief on color television receivers from Japan would have little, if any, adverse impact on the domestic industry. 1/ Following receipt of the Commission's advice, the President extended the OMA's with Taiwan and Korea from June 30, 1980, to June 30, 1982, and terminated the OMA with Japan on June 30, 1980, as scheduled.

The export ceilings under these agreements, as well as the actual U.S. imports from each of the three countries for which the agreements were in effect, are shown in table 3.1.

The Estimated Effects of the OMA's on Color Television Sets

The method of calculating the effects of the OMA's on color television sets is straightforward, with the use of estimated parameters of the statistical model presented in appendix C. All estimates were limited to the 12-quarter, or 3-year, period covering the third quarter of 1977 through the second quarter of 1980.

Effects on imports

MacPhee's extrapolation approach was used to estimate the volume of color television sets that would have been imported in the quarters in which the OMA's were in effect. 2/ The estimated effects are shown in table 3.2.

The total decrease in the volume of imports attributable to the OMA's was estimated to be 1,113,300 units. 3/ The effect in the third OMA year was smaller than in the other 2 years. This implies that the large reduction in imports of Japanese color television sets in the third OMA year was caused not only by the agreements but also by other factors. One factor that might also have contributed to the reduction was the substantial increase in capacity and production in Japanese-owned firms in the United States. 4/ Most inputs or parts used by Japanese-owned firms were made in Japan. Therefore, the increase in production in Japanese-owned firms in the United States reduced imports of assembled Japanese color sets.

1/ This is a judgment expressed jointly by Vice Chairman Bill Alberger and Commissioners George M. Moore, Paula Stern, and Michael J. Calhoun in Color Television Receivers and Subassemblies Thereof: Report to the President on Investigation No. TA-203-6 . . ., USITC Publication 1068, May 1980.

2/ MacPhee, op. cit., p. 75.

3/ The total reduction in imports was valued at $267 million based on the unit value of U.S. imports of color television sets in 1980.

4/ For expansion of capacity of Japanese-owned firms during the 3 OMA years, see USITC Publication 1153, June 1981.

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Table 3.1.--Export ceilings and actual U.S. imports of color television receivers, by specified periods, July 1, 1977-June 30, 1980

Source and item	July 1, 1977-June 30, 1978	July 1, 1978-June 30, 1979	July 1, 1979-June 30, 1980	Feb. 1, 1979-June 30, 1979	July 1, 1979-June 30, 1980	Feb. 1, 1979-Oct. 31, 1979	Nov. 1, 1979 June 30, 1980
Japan:							-
Complete sets:							-
OMA ceiling----------units---	1,560,000	1,560,000	1,560,000	-	-	-	-
Actual U.S. imports-----do----	1,608,668	925,396	381,561	-	-	-	-
Ratio of imports to OMA ceiling----------percent--	103.1	59.3	24.5	-	-	-	-
Incomplete sets:							
OMA ceiling----------units---	190,000	190,000	190,000	-	-	-	-
Actual U.S. imports-----do----	176,970	169,950	194,950	-	-	-	-
Ratio of imports to OMA ceiling----------percent--	93.1	89.4	102.6	-	-	-	-
Taiwan:							
Complete sets:							
OMA ceiling----------units---	-	-	-	153,368	373,426	-	-
Actual U.S. imports-----do----	-	-	-	152,942	341,185	-	-
Ratio of imports to OMA ceiling----------percent--	-	-	-	99.7	91.4	-	-
Incomplete sets:							
OMA ceiling----------units---	-	-	-	270,000	683,000	-	-
Actual U.S. imports-----do----	-	-	-	218,357	436,669	-	-
Ratio of imports to OMA ceiling----------percent--	-	-	-	80.9	63.9	-	-
Korea:							
Complete or incomplete sets:							
OMA ceiling----------units---	-	-	-	-	-	153,000	186,000
Actual U.S. imports-----do----	-	-	-	-	-	151,811	147,850
Ratio of imports to OMA ceiling----------percent--	-	-	-	-	-	99.2	79.5

Source: OMA's between the United States and Japan, Taiwan, and Korea; and U.S. Customs Service news releases, various issues.

Table 3.2.--Estimated effects of the OMA's on imports of color television receivers, July 1977-June 1980

(In thousands of units)

Period	Decrease in imports
1st OMA year: July 1977-June 1978	344.1
2nd OMA year: July 1978-June 1979	621.3
3rd OMA year: July 1979-June 1980	147.9

Effects on domestic producer prices

As expected, the imposition of the OMA's on color television receivers resulted in increases in the annual average producer price of color television sets according to the market model. The estimated effects ranged from a 0.37-percent (or 0.26 percent in constant dollars) increase in 1977 to a 4.07-percent (or 2.43 percent in constant dollars) increase in 1979. The following table shows the estimated effects of the OMA's on the average producer prices of color television sets, measured in current dollars.

Table 3.3.--Estimated effects of the OMA's on domestic producer prices of color television receivers, 1/ July 1977-June 1980

Period	Percentage of increase	Increase in unit value
1st OMA year: July 1977-June 1978	0.37	$ 1.29
2nd OMA year: July 1978-June 1979	3.14	11.05
3rd OMA year July 1979-June 1980	4.07	14.30

1/ The prices of color television receivers, which were used by the Bureau of Labor Statistics to calculate the Producer Price Index, are business-confidential data. The estimated effects of OMA's on the average domestic prices were derived from the Commission's data on the average unit value of color television sets. For example, the total quantity of shipments of U.S.-made and imported receivers in the third quarter of 1978 was 2,185,958 and the total value was $761,834,000, as shown in tables 3 and 4 in Color Television Receivers: U.S. Production, Shipments, Inventories, Exports, Employment, Man-hours, and Prices, Fourth Calendar Quarter 1980, USITC Publication 1127, February 1981. The calculated unit value was $348.51. The estimated effects were based on the 4-quarter average unit values.

Effects on domestic demand

Because the OMA's resulted in increased current prices, they reduced total sales of televisions in the United States to levels below those they would have reached in the absence of OMA's. The estimated price elasticity of demand for color television sets is -0.307. This measure of the responsiveness of sales to average price changes was used with the estimated price changes in table 3.3 to estimate the effects of the OMA's on the quantity sold to consumers. These estimated effects are shown in the following table.

Table 3.4.--Estimated effects of the OMA's on domestic demand for color television receivers, July 1977-June 1980

(In units)

Period	Decrease in domestic demand	Percentage decrease
1st OMA year:		
July 1977-June 1978	7,847	0.08
2nd OMA year:		
July 1978-June 1979	68,917	0.67
3rd OMA year		
July 1979-June 1980	73,725	0.75

The effects ranged from a decrease of 7,847 units in the first OMA year to a decrease of 73,725 units in the third OMA year. For the 3-year period, the average reduction in the quantity demanded attributable to the OMA's was estimated to be 0.50 percent.

Effects on domestic production and employment

The reductions in the volume of imports and the quantity purchased caused by the OMA's had some effects on domestic production. Without considering changes in input costs, technology, and other supply-side factors, the increase in domestic production caused by the OMA's was estimated by evaluating the OMA-related changes in the quantity demanded and imports. As shown in table 3.5, the estimated effects of the OMA's on domestic production ranged from an increase of 74,175 units in the third OMA year to an increase of 552,365 units in the second OMA year. The total increase for the period was 962,811 units. In an earlier study, Cunningham and Lin estimated the increase in domestic production due to the OMA with Japan to be 223,057 units. 1/ The estimate here is higher because it covers the OMA's with all three restraining countries.

1/ W. A. Cunningham and C. Y. Lin did not estimate the price elasticity of demand. The elasticity they used was taken from Margaret Buckler and Clopper Almond's paper entitled "Import and Export in an Input-Output Model," American Statistical Association Proceedings (1972). They also used this elasticity to estimate the welfare cost of the OMA in their paper entitled The Effects of the Orderly Market Agreement Between Japan and the United States Regarding Color TV Sets, University of Arkansas, December 1980.

Table 3.5.--Estimated effects of the OMA's on domestic production of color television receivers and employment, July 1977-June 1980

Period	Increase in production	Increase in employment 1/
	1,000 units	Man-years
1st OMA year:		
July 1977-June 1978	336.2	5,237
2nd OMA year:		
July 1978-June 1979	552.4	8,035
3rd OMA year:		
July 1979-June 1980	74.2	992
Total	962.8	14,264

1/ Increases in employment include those of related industries such as electronic components and accessories, electric lighting and wiring equipment, and household furniture.

The effects of the OMA's on domestic employment were estimated by applying input-output coefficients to the estimated changes in domestic production. As shown in the table 3.5, the estimated effects ranged from an increase of 992 man-years in the third OMA year to an increase of 8,035 man-years in the second OMA year. 1/ It is estimated that in the absence of the OMA's, the domestic color television and related industries would have employed an average of 4,755 fewer workers over the 3-year period.

Total U.S. production of color television receivers increased continuously, from 5.9 million units in 1976 to 10.7 million units in 1980. 2/ Total U.S. imports of color television sets declined sharply in 1979 and 1980, but the increases in domestic production and the decreases in the imports were not caused by the OMA's alone. Technological improvements may have also contributed to these two favorable developments.

As stated in various Commission publications, the labor requirement in the U.S. color television receiver industry has decreased steadily over the past decade. 3/ The direct labor required to produce one color television set was reduced from 5.83 man-hours in 1978 to 4.18 man-hours in 1980. 4/ Also,

1/ The estimates were based on the direct and indirect labor requirements for the radio, television, and communications industry (input-output table sector 56).

2/ See USITC Publication 1153, p. A-25. It is understood that the market share of foreign-owned firms increased during the 3 years the OMA's were in effect. Since these firms are classified as U.S. producers, this study has not disaggregated domestic production by ownership. One indirect effect that might be caused by the OMA's is related to increased foreign direct investments in the U.S. color television receiver industry. For U.S. production in 1978-80, see USITC Publication 1127, February 1981.

3/ See, for example, USITC Publication 1127, February 1981.

4/ It is believed that increased utilization of printed circuit boards, reduction in the number of parts needed, and intensified use of automatic assembly equipment were among those factors which reduced direct labor requirements.

real producer prices tended to decline in each quarter during 1974-80; technological improvements reduced real costs of production and strengthened the competitiveness of U.S. color sets. The reduction in real producer prices helped raise both the quantity of color sets purchased and the level of production. The increase in production was caused partially by technological change. Thus, the estimated increase in production attributable to the OMA's does not fully account for the actual increase in production. Increases in U.S. domestic production and export levels of color television sets demonstrated that the U.S. producers were able to compete with foreign suppliers in domestic markets as well as in foreign markets, and it appears unlikely that market shares left by Taiwan and Korea will be completely taken over by other nonrestraining countries.

CHAPTER 4. THE EFFECTS OF ORDERLY MARKETING AGREEMENTS ON NONRUBBER FOOTWEAR

This chapter analyzes the effects of the orderly marketing agreements in the nonrubber footwear industry. It consists of two sections. The first section gives background information on these agreements; the second presents the estimated effects of the OMA's on domestic prices, demand, production, and employment, as well as on the volume of U.S. imports of nonrubber footwear. The statistical model used to estimate the economic effects and the sample data are included in appendix D.

Background on Orderly Marketing Agreements on Nonrubber Footwear

U.S. imports of nonrubber footwear increased markedly since the mid-1960's, nearly doubling in value from $89.5 million in 1963 to $155.3 million in 1966. The rapid increase in the imports led to the Commission's first investigation on footwear. On January 15, 1969, the Commission issued a report 1/ at the request of the President under section 332 of the Tariff Act of 1930, in which it gathered information on the economic condition of the domestic industry and the effects of imports on the industry. The study concluded that both domestic production and imports are likely to continue to increase, and the future competitive position of the domestic producers would depend on their adoption of technological advances and ingenuity in design and style.

At the President's request, the Commission instituted an escape-clause investigation concerning imports of nonrubber footwear, under section 301(b)(1) of the Trade Expansion Act of 1962, on July 15, 1970. As a result of that investigation, the Commission was equally divided on the question of different views concerning injury. 2/ No Presidential action was taken on the basis of the Commission's report.

The Commission instituted a second escape-clause investigation on September 17, 1975, following receipt of a petition for import relief filed under section 201(b)(1) of the Trade Act of 1974 by the American Footwear Industries Association (AFIA), the Boot & Shoe Workers' Union, and the United Shoe Workers of America. Upon completion of this investigation, the Commission found that increased imports were a substantial cause of serious injury to the domestic industry. On February 20, 1976, the Commission submitted the results of the investigation to the President and recommended three courses of action to remedy the injury: tariff increases, tariff-rate quotas, and adjustment assistance. 3/ On April 16, 1976, President Ford announced that he had determined that relief in the form of tariffs or tariff quotas was not in the national economic interest and that he had concluded that adjustment assistance was the most effective remedy for relief of injury

1/ Nonrubber Footwear: Report to the President on Investigation No. 332-56 . . ., TC Publication 276, 1969.

injury. On January 15, 1971, the Commission reported to the President its

2/ Nonrubber Footwear: Report to the President on Investigation No. TEA-I-18 . . ., TC Publication 359, January 1971.

3/ Footwear: Report to the President on Investigation No. TA-201-7 . . . , USITC Publication 758, February 1976.

to the U.S. footwear industry. He announced that he was directing the Secretaries of Labor and Commerce to give expeditious consideration to petitions for such assistance.

In response to a resolution by the Senate Committee on Finance, the Commission instituted a third escape-clause investigation on nonrubber footwear (the second under the 1974 Trade Act provisions) on October 5, 1976. On February 3, 1977, the Commission again reported to the President that the domestic footwear industry was being seriously injured by imports and recommended that a tariff-rate quota system be imposed to remedy the injury. 1/ President Carter rejected the Commission's recommendation on the ground that it would be inflationary, and directed the Special Representative for Trade Negotiations to negotiate OMA's with Taiwan and Korea instead. 2/ Both countries agreed to restrain their exports to the United States.

The OMA's with Taiwan and Korea continued for 4 years, from June 28, 1977, to June 30, 1981. The restrained goods covered a wide variety of leather, plastic, and fiber footwear, including dress, athletic, and work shoes, boots, and other casual shoes. The agreements permitted shifts between categories and carryovers of a category which were not filled in any control year. 3/ Quotas on leather footwear (other than athletic) from Korea were substantially underutilized for most of the quota period. The agreed-upon export quotas in each category, the amended quotas, and the actual imports of nonrubber footwear are shown in table 4.1.

On December 5, 1980, about 7 months prior to the expiration of the OMA's, the Commission commenced an investigation under section 203(i)(2) and (i)(3) of the Trade Act of 1974 in order to advise the President of its judgment as to the probable economic effect of the extension, reduction, or termination of relief on the footwear industry. On April 22, 1981, the Commission advised President Reagan to extend the OMA with Taiwan with regard to the bulk of the footwear covered thereunder for an additional 2 years at the 1980-81 quota levels. The Commission also advised that termination of the import relief presently in effect with respect to imports from Korea--principally athletic footwear--would not have a significant adverse economic effect on the domestic industry and therefore need not be extended. 4/ On June 30, 1981, President Reagan announced that he had decided not to extend either of the OMA's and that relief would therefore be allowed to terminate at the close of June 30.

1/ Footwear: Report to the President on Investigation No TA-201-18 . . . , USITC Publication 799, February 1977.

2/ For a more detailed description of Commission investigations on nonrubber footwear, see app. B of Footwear: Report to the President on Investigation No. TA-203-7 . . . , USITC Publication 1139, April 1981. The publication also contains a complete description of the OMA's.

3/ For Taiwan, there can be a shift of up to 10 percent into the leather and vinyl categories; for the other category, a 15-percent shift was agreed to. For Korea, a 10-percent shift into leather and a 15-percent shift into the athletic and all other categories were permitted.

4/ The Commission further advised that, if import relief with respect to Taiwan were to be extended, the certificate-of-origin program for imports of footwear from Hong Kong should likewise be extended, since the program is an adjunct to the relief with respect to Taiwan. For details of this investigation, see USITC Publication 1139, April 1981.

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Table 4.1.--Nonrubber footwear: OMA quotas and adjustments for the 1st through 4th restraint periods, by types

Source and type	Original quota	1st-year 1/ adjustments: Shifts	Borrow	Total	Amended quota	Actual imports	Balance	Share of quota filled
	1,000 pairs							Percent
Taiwan:								
Leather	9,760	976	-	976	10,736	10,736	-	100
Plastic	104,680	-1,910	-	-1,910	102,770	102,770	-	100
Other	7,560	934	-	934	8,494	8,494	-	100
Total	122,000	0	-	0	122,000	122,000	-	100
Korea:								
Leather excluding athletic)	11,520	-3,222	233	-2,989	8,531	8,531	-	100
Athletic and other	21,480	3,222	3,175	6,397	27,877	27,877	-	100
Total	33,000	0	3,408	3,408	36,408	36,408	-	100

	Original quota	Adjustment from 1st year	Adjusted quota	2d-year 2/ adjustments: Shifts	Borrow	Total	Amended quota	Actual imports	Balance	Share of quota filled
	1,000 pairs									Percent
Taiwan:										
Leather	10,000	-	10,000	1,000	-	1,000	11,000	11,000	-	100
Plastic	107,250	-	107,250	-2,163	-	-2,163	105,088	104,792	296	99.7
Other	7,750	-	7,750	1,163	-	1,163	8,912	8,912	-	100
Total	125,000	-	125,000	0	-	0	125,000	124,704	296	99.8
Korea:										
Leather (excluding athletic)	12,740	-233	12,507	-	-	-	12,507	3/ 7,778	4,729	62.2
Athletic and other	23,760	-3,175	20,585	-	-	-	20,585	20,585	0	100
Total	36,500	-3,408	33,092	-	-	-	33,092	28,363	4,729	85.7

	Original quota	Adjustment from 2d year	Adjusted quota	3d-year 4/ adjustments: Shifts	Borrow	Total	Amended quota	Actual imports	Balance	Share of quota filled
	1,000 pairs									Percent
Taiwan:										
Leather	10,240	-	10,240	1,024	-	1,024	11,264	11,264	0	100
Plastic	109,820	296	110,116	-2,215	-	-2,215	107,901	107,901	0	100
Other	7,904	-	7,940	1,191	258	1,667	9,389	9,389	0	100
Total	127,964	296	128,296	0	7,680	7,680	128,554	128,554	0	100
Korea:										
Leather (excluding athletic)	13,090	-	13,090	-	-	-	13,090	4,144	8,946	31.7
Athletic and other	24,410	-	24,410	-	-	-	24,410	23,372	1,038	95.7
Total	37,500	-	37,500	-	-	-	37,500	27,516	9,984	73.4

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Table 4.1.--Nonrubber footwear: OMA quotas and adjustments for the 1st through 4th restraint periods, by types--Continued

	Original quota	Adjustment from 3d year	Adjusted quota	4th-year 5/ adjustments			Amended quota	Actual imports	Balance	Share of quota filled
				Shifts	Borrow	Total				
	1,000 pairs									Percent
Taiwan:										
Leather	11,528	-	11,528	1,048	-	1,048	12,576	10,687	1,889	85
Plastic	111,352	-	111,352	-1,048	-	-1,048	110,304	105,595	4,709	96
Other	7,862	-258	7,604	-	-	-258	7,604	7,558	46	99
Total	130,742	-	130,484	0	-	-258	130,484	123,840	6,644	95
Korea:										
Leather (excluding athletic)	10,989	-	-	-	-	-	-	4,447	6,542	40
Athletic and other	28,451	-	-	-	-	-	-	28,451	0	100
Total	39,440	-	-	-	-	-	-	32,898	0	83

1/ From June 28, 1977, to June 30, 1978.
2/ From July 1, 1978, to June 30, 1979.
3/ Korea was under quota, and lost 4,729 thousand pairs.
4/ From July 1, 1979, to June 30, 1980.
5/ From July 1, 1980, to June 30, 1981.

Source: USITC Publication 1139, and the U.S. Customs Service.

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The Estimated Effects of OMA's on Nonrubber Footwear

By using estimated coefficients of the statistical model as described in appendix D, estimates of the effects of the OMA's on domestic prices, consumption, production, employment, and import levels for nonrubber footwear were derived. All estimated effects of the OMA's are included in table 4.2.

Effects on imports

Although the two OMA's limited the volume of U.S. imports of nonrubber footwear from the restraining countries, the quantitative restraints were largely offset by increases in the imports from nonrestraining countries. Because the production of footwear requires relatively low technological requirements compared with production in other industries, and is highly labor intensive, substitution of exports from labor-rich nonrestraining countries for exports from the OMA countries occurred. This study is interested in the effect of the OMA's on imports of nonrubber footwear from all countries; thus, the estimated income elasticity in the import demand equation (D.2B in app. D) and MacPhee's extrapolation method were used to calculate the effects of the OMA's on the levels of total imports. The estimated annual reductions in imports of nonrubber footwear attributable to OMA's ranged from 6.12 percent in 1979 to 8.65 percent in 1977, as shown in table 4.2. In the absence of the OMA's, the estimated total level of the imports in the 3-year period would have been 87.92 million pairs higher than the actual level of the footwear imports. 1/

Table 4.2.--Estimated effects of the OMA's on nonrubber footwear, 1977-79

Item	1977	1978	1979
Changes in imports:			
million pairs	-31.84	-31.33	-24.75
Percent of observed imports	8.65	8.39	6.12
Changes in domestic price:			
per pair	$0.04	$0.10	$1.07
Percent of observed price	0.47	1.13	10.05
Changes in demand:			
million pairs	-0.440	-1.055	-9.573
Percent of observed demand	0.06	0.13	1.21
Changes in domestic production:			
million pairs	31.40	30.28	15.18
Percent of observed domestic shipments	7.51	7.23	3.81
Changes in domestic employment: 1/			
man-years	18,226	17,666	9,406

1/ Changes in employment include those of related industries such as leather tanning and finishing, plastics and synthetic materials, and textiles.

1/ The total reduction in imports was valued at $527 million based on the unit value of U.S. imports of nonrubber footwear in 1979.

Effects on domestic producer prices

During the sample period, the General Producer Price Index for all commodities rose more rapidly than the average producer price of nonrubber footwear. Thus, the real producer price (i.e., the producer price of nonrubber footwear deflated by the General Producer Price Index) declined slightly over the sample period. 1/ Annual increases in the average producer price, above what they would have been without export restraints, were estimated to range from 0.47 percent in 1977 to 10.05 percent in 1979. In current dollars, the estimated increases in the average producer price during the 3 years ranged from $0.04 per pair in 1977 to $1.07 per pair in 1979. 2/

Effects on domestic demand

Domestic consumption, or demand for nonrubber footwear, is affected by the levels of domestic prices and imports. The estimate of the price elasticity of demand for nonrubber footwear is -0.12, and the estimated OMA effects on the average producer price for each of the 3 years were increases of 0.47, 1.13, and 10.05 percent, respectively. Therefore, the estimated effects of the OMA's on domestic demand ranged from a reduction of 440,093 pairs in 1977 to a reduction of 9,573,229 pairs in 1979, as shown in table 4.2. The total reduction in domestic demand due to the OMA's in the 3 years was 11,068,000 pairs.

Effects on domestic production and employment

As shown in figure A.4 (app. A), the effects of the OMA's on domestic production were determined by changes in domestic demand and imports. Estimates of the annual effects on domestic production ranged from an increase of 15.18 million pairs in 1979 to 31.40 million pairs in 1977. For the 3-year period, the OMA's increased domestic production by an estimated 76.9 million pairs, valued at $815 million in 1979 dollars. With this figure, the effect of the OMA's on domestic employment may be estimated. Based on direct and indirect labor requirements for the footwear and other leather products industry (sector 34 of the input-output table), the estimates of the annual effects of the OMA's on domestic employment ranged from 9,406 man-years in 1979 to 18,226 man-years in 1977. The OMA's saved an estimated average of 15,099 jobs each year over the 3-year period.

1/ The sample period of this study covers 1967 to 1979. All sample data are included in app. D.

2/ The estimates were based on the average unit values of domestic shipments calculated from total quantities and values of shipments published in Footwear Manual, 1981, AFIA, p. 4. The average unit values for 1977, 1978, and 1979 were $8.53, $9.20, and $10.60, respectively.

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CHAPTER 5. CONCLUSIONS

The statistical analyses of the effects of the VRA's in the steel industry and the OMA's in the television and footwear industries found similarities and differences in the three industries.

As expected, in general, the arrangements and agreements served the purpose of limiting U.S. imports of steel, color television receivers, and footwear. As estimated by this study, the VRA's reduced the volume of steel imports by 20.1 percent. The OMA's decreased the volumes of imports of color television receivers and footwear by an estimated 3.7 percent and 7.7 percent, respectively. The VRA's in the steel industry seem to have been more effective than the OMA's in the color television receiver and footwear industries. This was related to the degree of substitutability of exports from the nonrestraining countries for exports from restraining countries.

Substitutability depends on the ability of nonrestraining countries to produce similar products and the efficiency with which they do so. Compared with the other two industries, the steel industry has had less substitutability because it requires a larger amount of capital equipment and relatively skilled labor. In the color television receiver and footwear industries substitutability is high because these industries require neither as much capital equipment nor skilled labor as the steel industry. In the case of color television receivers, labor-rich countries such as Korea were able to expand their production capacity rapidly and capture much of the market share lost by Japan. Therefore, source substitutability appears to be an important determinant of the effectiveness of the restraints.

Statistical results of this study also indicate that the VRA's and the OMA's resulted in increased domestic prices and decreased volumes of imports from the restraining countries. Because the volume of the imports declined and prices increased, domestic producers in the three industries were able to expand their production in order to meet market demand. It was estimated that domestic production in steel, color television receivers, and footwear increased by 1.7, 3.3 and 6.6 percent, respectively. Increased production also meant increased labor requirements. Thus, the restraints had a favorable effect on employment in the U.S. industries. The VRA's increased domestic employment by 114,702 man-years in the steel and its related industries. The OMA's increased domestic employment by 14,264 man-years in the color television receiver and its related industries, and by 45,298 man-years in the footwear and its related industries.

While there was a temporary increase in employment during the time the restraints were in effect, another goal of the ERA's and the OMA's is the orderly adjustment by the domestic industry to import competition. Evaluation of the effectiveness of the restraints in accomplishing the adjustment process must depend on the subsequent performance of the industry. Though the statistical results of this study suggest that the OMA's in the footwear industry were more effective in increasing domestic production than those in the color television receiver industry, during the past 5 years, market penetration by imports of nonrubber footwear has been persistently higher than by imports of color television receivers. Since the manufacture of footwear is labor intensive relative to television manufacturing, the U.S. shoe industry has been less able to compete with relatively low-labor-cost sources, such as Korea or Taiwan, than has the television industry.

APPENDIX A

THEORETICAL FRAMEWORK FOR THE ANALYSIS OF TRADE RESTRICTIONS

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This appendix provides a basic economic analysis of voluntary export restraints (VER) and other trade restrictions. A graphical presentation, using partial equilibrium analysis, is employed to describe the impact of VER's on the level of imports, the world market price, domestic production, consumption, and the price of the domestic substitute in the importing country.

The exposition begins with the case of free trade under a price-takers' market, proceeds to various types of protection, and finishes with the case of VER's under a price-searchers' market. 1/ This sequence is appealing for two reasons. The presentation of the free trade/price-takers' market case first is in the tradition of neoclassical economics, which customarily uses this model to explain gains and losses from trade restrictions. Second, beginning with free trade and price-takers' market and ending with VER's and price-searchers' market represent a progression, not only from less to more realistic cases, but also from simple to more complicated cases.

The Effects of Tariffs and Quotas Under Price-Takers' Market

This section presents the traditional analysis of welfare gains and losses associated with trade restrictions under price-takers' market. Consider the simple case in which the following assumptions hold:

1. Imported and domestic goods are perfect substitutes.
2. There are many foreign and domestic suppliers.
3. Foreign supply is infinitely elastic within the relevant range.
4. Transportation costs are zero.

The partial equilibrium position of commodity A with free trade is shown in figure A.1. Domestic demand for commodity A is assumed to be responsive to price changes and is represented by the demand curve DD'. Domestic supply is assumed to take place under conditions of increasing costs, and is represented by the supply curve SS'. The equilibrium price in the importing country equals the world price, OP_w. Domestic consumption is OQ_4, as shown from the demand curve, and domestic producers would supply quantity OQ_1. The difference between domestic consumption and production, Q_1Q_4, is supplied by imports.

To evaluate welfare gains and losses associated with free trade, the concepts of consumer and producer surplus are employed. Consumer surplus is the difference between the market price consumers actually paid for commodity

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1/ This study classifies market structures into two categories: price takers' and price searchers'. Under a price-takers' market each supplier provides so small a portion of the supply that he has no control over the price. Conditions of this market structure are the same as those under perfect competition. In a price-searchers' market each supplier has some effect on price. Conditions of this market structure are about the same as those under imperfect competition. For details of these two market structures, see A. A. Alchian and W. R. Allen, University Economics, Wadsworth Publishing Co., Belmont, Calif. 1968.

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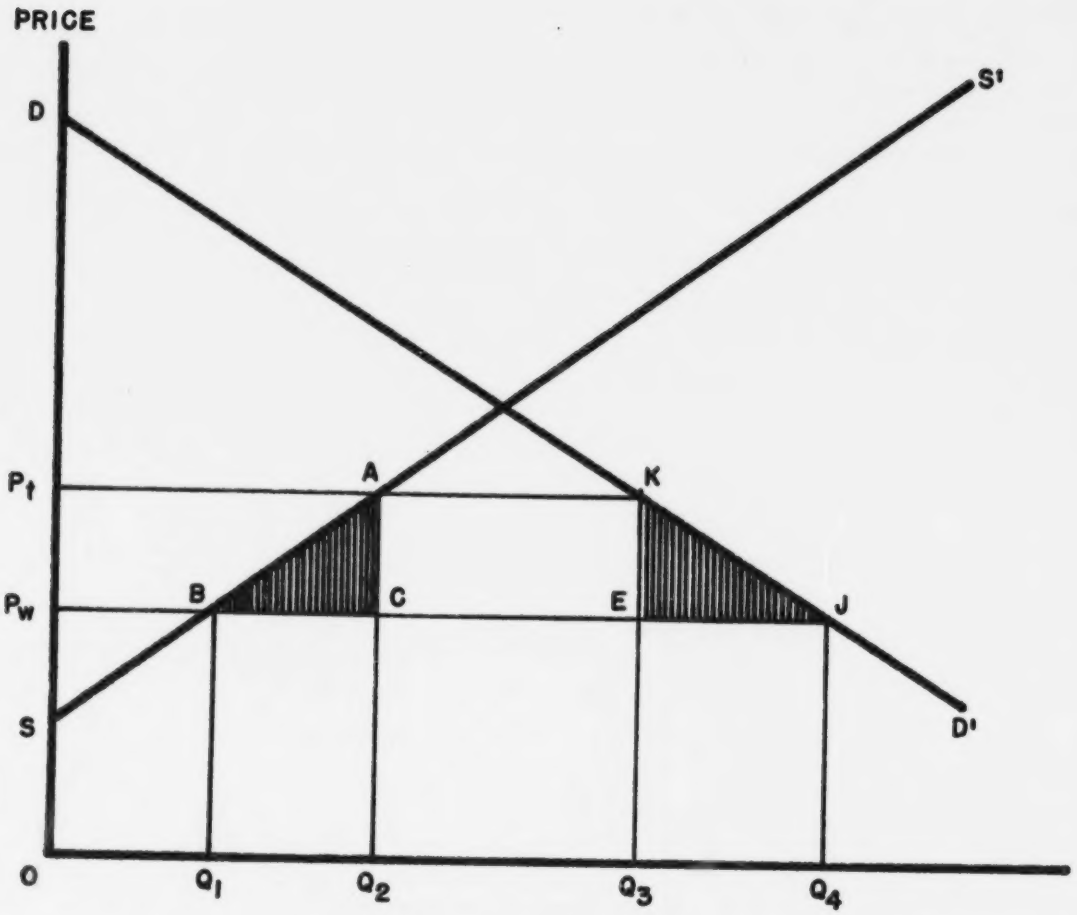
Figure A.1

The Effects of Import Tariff or Quota
Under a Price-takers' Market



DD' = domestic demand curve for commodity A
SS' = domestic supply curve for commodity A
OP_w = world price of commodity A
OP_t = domestic price of commodity A inclusive of tariff P_tP_w
OQ_1 = domestic production at price OP_w
OQ_2 = domestic production at price OP_t
OQ_3 = domestic consumption at price OP_t
OQ_4 = domestic consumption at price OP_w
DJP_w = consumer surplus at price OP_w
SBP_w = producer surplus at price OP_w
ACB and KJE are efficiency losses due to the imposition of an ad valorem tariff or a quota

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A and the price they were willing to pay for each level of consumption. The price consumers are willing to pay for each unit is shown by the demand curve. Consumer surplus arises because all units sell at the same price, but some units are valued more highly than others by purchasers. For instance, at price OP_w in figure A.1, total consumer surplus is the difference between what consumers actually pay, area OP_wJQ_4 and the total amount consumers were willing to pay, area $CDJQ_4$. Consumer surplus is equal to the area of triangle DJP_w.

Producer surplus is defined to be the difference between producer revenue and the supply cost of each unit of output. It arises because all units sell at the same price, but some units cost less to produce than others. In reference to supply curve SS' in figure A.1, at price OP_w the quantity supplied domestically will be OQ_1 and revenue will equal the area OP_wBQ_1, and domestic producers earn a producer surplus equal to the area of triangle SBP_w.

Tariff case

Now, assume that the importing country places an ad valorem tariff, at the rate P_tP_w/OP_w, on commodity A, causing an increase in domestic price to OP_t. The increase in the domestic price will induce domestic producers to increase their supply from OQ_1 to OQ_2. Facing a higher price, households would reduce their consumption of commodity A, and the total quantity consumed will decline from OQ_4 to OQ_3. 1/ The increasing domestic production and the falling domestic consumption brought about by the higher domestic price would reduce the level of imports from Q_1Q_4 to Q_2Q_3. Increasing the price from OP_w to OP_t reduces the amount of consumer surplus from DJP_w to DKP_t and increases producer surplus from SBP_w to SAP_t.

The distribution effects of a tariff on commodity A consist of a reallocation of consumer surplus. In figure A.1, when a tariff is imposed, consumers will lose a portion of consumer surplus equal to area P_wP_tKJ as the domestic price increases to OP_t. Part of the consumers' loss, area P_wP_tAB,

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1/ The difference between OQ_3 and OQ_4 is Q_3Q_4, which is the decline in domestic consumption caused by the imposition of the tariff. It is called the consumption effect of the tariff. Likewise, the increase in the production, Q_1Q_2, is called the production effect of the tariff.

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will be reallocated to domestic producers in the form of producer surplus. Another part of consumers' loss, area AKEC, will go to the governmental body collecting the tariff revenues. To this extent, the tariff merely reallocates consumer surplus from consumers to producers and government. However, two parts of consumer surplus, area ACB and area KJE, are net losses and are not reallocated. Area ACB represents the costs to the economy of increasing domestic output by utilizing additional scarce domestic resources rather than purchasing lower priced imports. Area KJE represents the loss to consumers that occurs as some consumers are priced out of the market. Area ACB plus area KJE is commonly referred to as the "efficiency loss" or "deadweight loss" of the tariff because it is not recaptured by any other sector of the economy.

Quota case

Import quotas can be examined by using the same framework. Given the four assumptions mentioned previously, if the import quota of commodity A is set at Q_2Q_3, the effects of the quota on price and quantity will be identical to those of the tariff described above, provided that a quota is completely filled. 1/ The major difference between the effects of a tariff and an import quota concerns area AKEC, that portion of the consumer surplus accrues to the government under a tariff. If the government auctions off import licenses, it again earns revenues equivalent to area AKEC and the tariff and the import quota are equivalent in all respects. However, if import licenses are distributed to domestic importers without cost, then the importers receive these revenues rather than the government.

Voluntary Export Restraints

This section discusses a conceptual framework used to analyze the effects of voluntary export restraints on domestic price, production, consumption, and levels of imports. Both price-takers' and price-searchers' markets are considered here. Price and output determinations of these two market structures are different. A price searcher can search the price and output level at which profits are maximized. Firms which operate under a price-takers' market can only take the price set by market forces.

1/ For further discussion on the equivalence of tariffs and quotas, see J. Bhagwati's "On the Equivalence of Tariffs and Quotas" in R. G. Baldwin, et al., eds., Trade, Growth, and the Balance of Payments, University of Chicago Press, 1965.

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Price-takers' market in domestic production

Consider first a simple case in which there is a single exporting country. Usually, the exporting country under the ERA is the major supplier of the commodity under investigation. It is likely that there will be nonrestraining countries under most agreements. It is also possible that all exporting countries are covered by ERA's. The term "single exporting country" is used here in a broad sense. If a group of countries bargains as a single unit, the group is treated as a single country for purposes of this analysis. 1/

Figure A.2 again presents the case of a price-takers' market in domestic production and a perfectly elastic supply of imports. Under free trade, exporting countries supply Q_1Q_6 at price OP_w. Domestic production is equal to OQ_1, and domestic consumption is equal to OQ_6.

Now assume that there is only one exporting country or all exporting countries are included in an ERA. Under an ERA, the level of imports decreases to Q_3Q_4, the amount set by the agreement. Domestic consumption shrinks from OQ_6 to OQ_4, and a new equilibrium price OP_1 is established.

The effects on prices and quantities of the ERA are identical to an import quota of the same size or of a tariff at a rate P_1P_w/OP_w. The difference is that under an ERA, the additional revenue of remaining imports (Q_3Q_4), equal to areas A and B, is received by the exporters. 2/ Under an import quota, these revenues are received by the importers, and under a tariff they are received by the government of the importing country.

1/ Member countries of the European Economic Community may be treated as a single exporting country.

2/ Consumers are willing to pay the price OP_1 when the quantity demanded is OQ_4. The world price is OP_w. P_1P_w is the additional revenue per unit of remaining imports. Areas A and B are commonly referred to as the windfall profit. C. Fred Bergsten extensively discussed distributions of windfall profit between foreign exporters and domestic importers in his paper titled "On The Nonequivalence of Import Quotas and Voluntary Export Restraints," in Toward a New International Economic Order: Selected Papers of C. Fred Bergsten, 1972-1974, Lexington, Mass., 1975, pp. 157-189.

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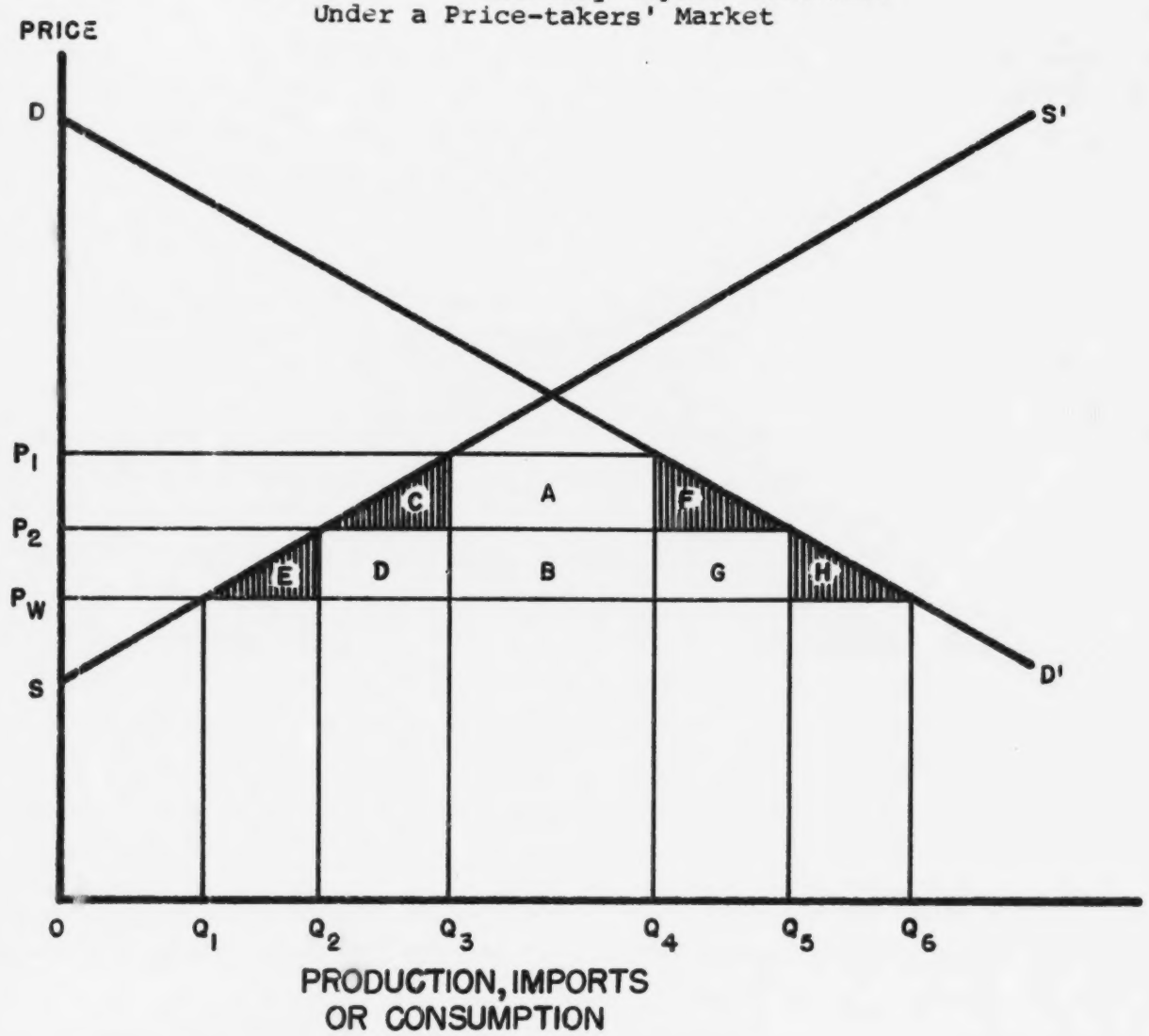
Figure A.2

The Effects of Voluntary Export Restraint
Under a Price-takers' Market



DD' = domestic demand curve for commodity A
SS' = domestic supply curve for commodity A
OP_W = world price of commodity A
OP_1 = domestic price of commodity A without the existence of the nonrestraining country
OP_2 = domestic price of commodity A with the existence of the nonrestraining country
OQ_1 = domestic production at price OP_W
OQ_2 = domestic production at price OP_2
OQ_3 = domestic production at price OP_1

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Next assume that there is a nonrestraining country or that the ERA does not cover all exporting countries. The export ceiling for the restraining country is set at Q_3Q_4, the same amount as before. In this case, the price rises to only OP_2 where it is restrained by imports from the higher cost, nonrestraining country. Exports of Q_2Q_3 and Q_4Q_5 arrive from the nonrestraining country. Hence, the ERA is less costly to consumers but less beneficial to domestic producers. It is also less beneficial to the low-cost, restraining country since it gains only Area B as implicit compensation for restricting its exports. But the nonrestraining country, which could not otherwise compete with the low-cost, restraining country, gains an opportunity to enter the market or to expand its exports.

To repeat, under an ERA, the restraining country receives greater revenue per unit of reduced quantity of exports. The additional revenue per unit of sales can be thought of as a compensation, ultimately paid by consumers, to the exporting country for "volunteering" to restrict its exports.

The ERA is agreed to by the government of the exporting country and it must police the quantity of exports. It can do this in several ways and each will have a different effect on the distribution of the benefits just discussed. One way to control exports is to auction export rights to its domestic producers. In this way, the government captures the increased unit revenues from the proceeds of the auction. Alternatively, it can distribute the rights free of charge, either directly to producers or indirectly via an industry association. Often, export rights are distributed to exporters in proportion to shares of their exports prior to the ERA.

Because of the increased unit revenue caused by the ERA, export rights are valuable. Consequently, sometimes government acts to prohibit their resale; in other cases, an active secondary market in export rights exists. 1/

An additional effect of an ERA which cannot be shown with the model depicted in figure A.2 is product switching. When exporters are limited in terms of the number of units of a differentiated product, they will often substitute high-value-product varieties for low-value ones. Consequently, the value of imports (at world prices) usually does not fall as much as the quantity.

1/ In his article titled "Voluntary Export Restraints and the GATT's Main Escape Clause" The World Economy, November 1980, B. Hindley stated: "In Taiwan and South Korea the export quota market's existence is 'an open secret'. . . ." Transfers of export quotas are not permitted in Taiwan and Korea. In Hong Kong, the export quotas are proprietary and can be sold legally and competitively. The article contains a complete discussion on distribution of the profits of export quotas.

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Price-searchers' market in domestic production

This section analyzes the effect of an ERA when domestic producers operate in a price-searchers' market. Two models are included: in the first, it is assumed that there is a single exporting country or group of countries; in the second, it is assumed that there are two exporting countries, or groups of countries and one is a nonrestraining country. Exports from the nonrestraining country can be substituted for exports from the restraining country.

Single exporting country.--The single exporting country case is shown in figure A.3. On the left side, EE^F is the supply of imports from the exporting country under free trade. In the right-hand panel, DD' represents total domestic demand for the good, and RJFD' represents the remaining demand for domestic production after the market has absorbed the import. RJFD', is then the effective demand faced by domestic producers. To maximize profits, producers will equate marginal cost, shown by MCM'C', with marginal revenue, RMR^F, derived from RJFD'; 1/ the market is cleared at price $O'P_0$ with total domestic consumption $O'C^F$ consisting of $O'Q^F$ domestic production and OM^F imports. 2/

Now suppose an ERA, permitting imports equal to OM^V, is instituted. The supply of imports will now be shown by EE^V and the remaining demand for domestic production by KJFD'. 3/ Equating marginal cost to the new marginal revenue curve, $K'MR^V$, means that domestic producers will set their price at $O'P_1$. Domestic consumption will fall to $O'C^V$ and domestic production will rise to $O'Q^V$. 4/ If the marginal cost is low enough for the domestic industry, as in curve $MC_sM'C'_s$, domestic production will fall from $O'Q^F_S$ to $O'Q^V_S$.

Two exporting countries.--Next consider a case with two exporting countries in which the lower cost, restraining country becomes subject to an ERA. Because substitution between the exports of the two countries can occur, imports will decrease by less than the decrease in exports of the restraining country.

1/ It is assumed that firms have identical marginal cost curves.

2/ The impact of the tariff is ignored here. Usually, a tariff is imposed on the restrained commodity. Since the tariff rate for the commodity is assumed to be constant, i.e., the imposition of the VER would not change the tariff rate, the omission of a tariff in this case would not reverse any conclusions to be reached.

3/ It is assumed that the demand curves facing the firms and the remaining demand curve have the same price elasticity.

4/ The marginal revenue curve will be discontinuous at the output levels corresponding to the kinks at J and F. The horizontal distance between DD' and KJ equals the quantity of the export quota, OM^V, as shown in Fig. A.3.

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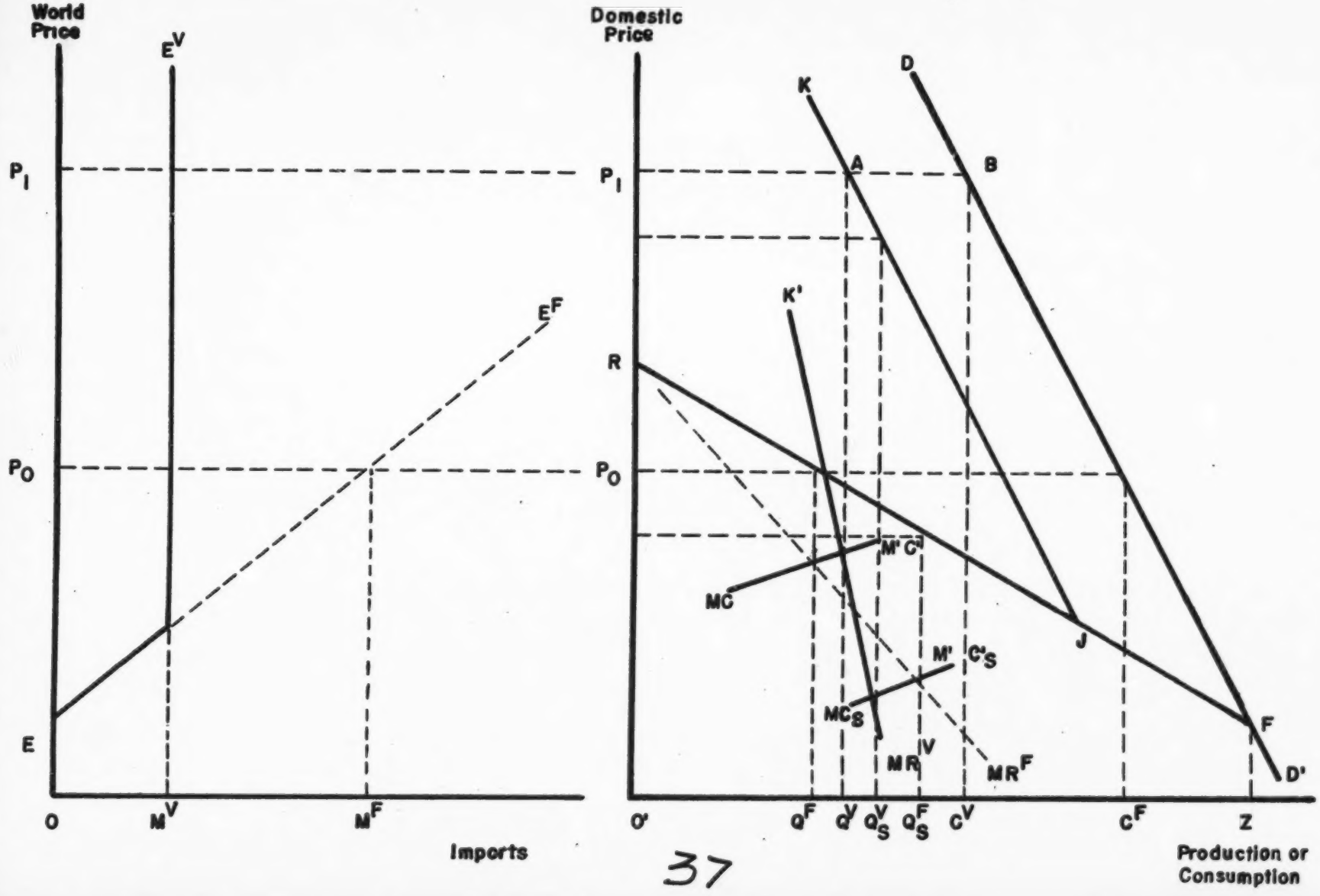
Figure A.3

The Effects of Voluntary Export Restraint under a Price-searchers' Market: Without a Nonrestraining Exporting Country



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In figure A.4, the principal change from figure A.3 as the result of the addition of nonrestraining country is that the left-hand panel has two country supply curves, EE_B^F and EE_C, in addition to the total import supply curve, EE^F, which is the sum of the two country curves under free trade. 1/ Much like before, free trade results in price of $O'P_0$ at which the importing country imports OM^F from the two exporting countries, OM_B^F from Country B and OM_C^F from from Country C.

When an ERA is instituted by the low-cost restraining country, its export supply curve becomes EE_B^V. The remaining demand curve facing the domestic producers changes from RJFD' to KJFD', from which the marginal revenue curve KMR^V is established. The domestic producers now set their price at $O'P_1$, and the price rises. Then, the nonrestraining country increases its exports to OM_C^V. 2/

With the domestic industry operating under a price-searchers' market, the imposition of the ERA will lead to increases in domestic prices and to decreases in both imports and domestic consumption. However, an ERA can lead to either an increase or a decrease in domestic production. 3/ Domestic production will increase if the marginal cost of domestic production is high enough, as in curve MCM'C' but will fall if the marginal cost is low enough, as given by curve $MC_sM'C'_s$. Also, the quantity of imports could increase if there exist economies of scale in the nonrestraining country but not in the importing country.

As shown in figures A.1 through A.4, the imposition of the ERA will affect the levels of domestic production, consumption, price, and imports of the commodity. If the restraining country is the largest and the most

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1/ EE_B is export supply curve of the restraining country B and EE_C is export supply curve of the nonrestraining country C.

2/ Under the assumption that the restraining country is the more efficient supplier, the change in imports from the restraining country, $M_B^V M_B^F$, is greater than the change in imports from the nonrestraining country, $M_C^F M_C^V$, as shown in figure A.4. Thus, the level of total imports will decline.

3/ In her model Takacs pointed out a special case that if the good being restrained is produced under monopolistic conditions and the slope of the monopolist's marginal cost curve is small, the restraint may decrease, rather than increase, domestic production.

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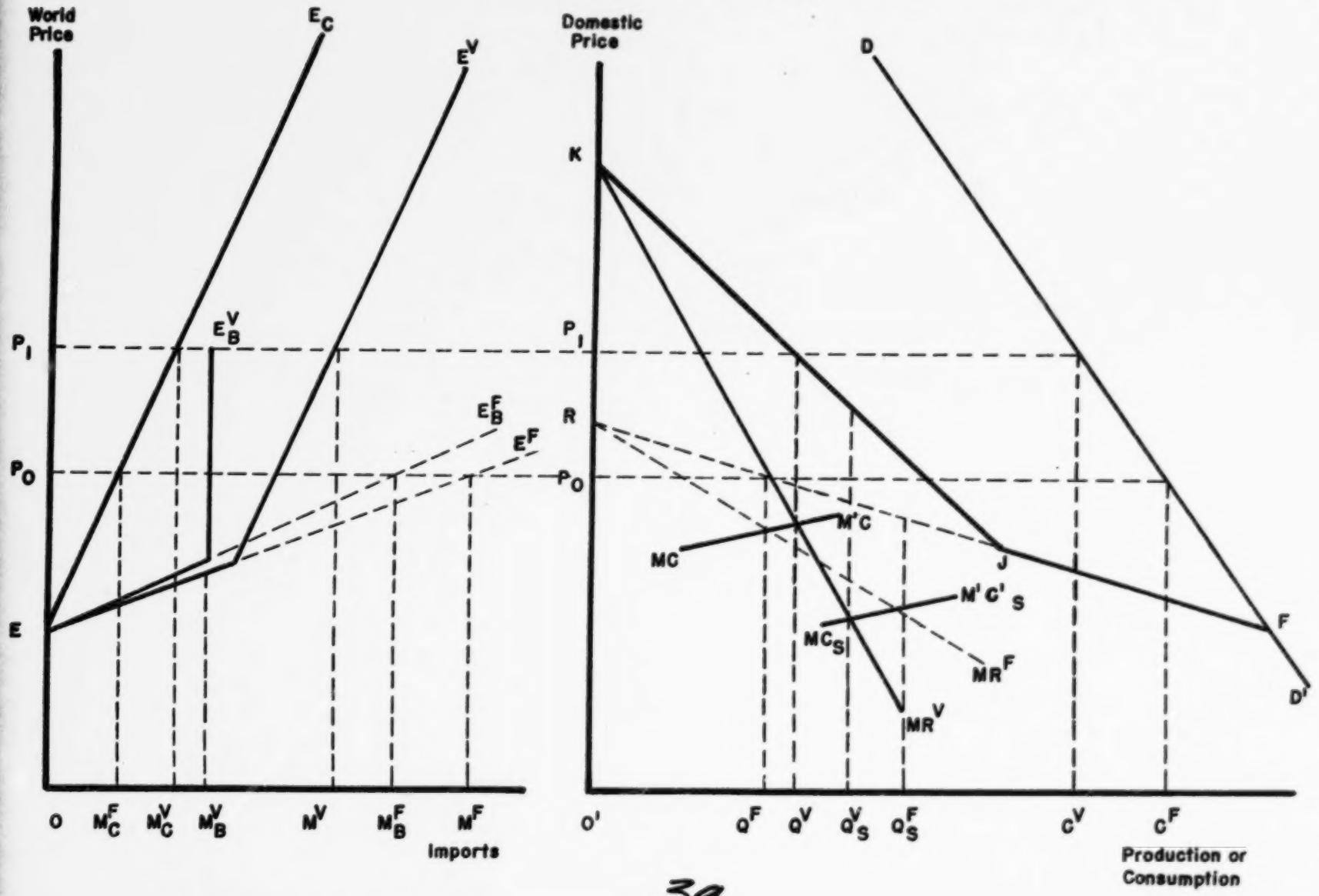
Figure A.4

The Effects of Voluntary Export Restraint under a Price-searchers' Market With a Nonrestraining Exporting Country



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efficient supplier, a set of hypotheses may be formulated from the above graphical analysis. The hypotheses of this study are (1) imports of the commodity from the restraining country are expected to fall; (2) domestic production of the commodity is expected to rise unless the domestic industry has large fixed costs relative to variable costs; (3) the domestic price of the commodity is expected to rise; and (4) domestic consumption of the commodity is expected to decline.

The following appendices will empirically test the validity of each of these hypothesized effects of the ERA's in steel, color television receiver, and nonrubber footwear industries. In addition, the magnitude of these effects on each of the three industries will be estimated.

APPENDIX B

STATISTICAL ANALYSIS OF THE VRA'S IN THE STEEL INDUSTRY

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This appendix is a statistical analysis of the VRA's in the U.S. steel industry. The analysis provides the estimates of the effects of the VRA's on the levels of steel imports, domestic price, consumption, production, and employment. Section 1 describes the specification of a statistical model of the U.S. steel industry. Section 2 presents the empirical results that were used to estimate the economic effects. Section 3 explains procedures for calculating these effects. All sample and related data are included in section 4.

Specifications of the model

There are several statistical models for the U.S. steel industry. Each is tailored to meet individual research requirements. 1/ For instance, R. A. Crandall recently developed a model of price and import penetration to explain the timing and the magnitude of the loss of market shares by U.S. steel producers. C. I. Higgins built a comprehensive sector model for the purpose of investigating demand and production relationships for the steel industry. Since the purpose of this study is to examine the effects of the VRA's, the following specifications are limited to those variables that may affect domestic price, production, consumption, and levels of imports under the VRA's.

The market structure for the U.S. steel industry is assumed to be a price-searchers' market or imperfect competition. Higgins argues that, until 1958 at least, the industry followed the price leadership of the U.S. Steel Corporation. While others have described the market structure as everything from highly competitive to monopolistic, Adelman argues that the steel industry follows a group interest, acting as if the group was a cartel. 2/ Under the assumption of a price-searchers' market structure, the two-exporting-country case analyzed in figure A.4 (app. A) can be used as a conceptual framework for specifying an empirical steel model.

In order to estimate the effect of a voluntary export restraint when the restrained good is produced in the importing country by an industry under conditions of price-searchers' market, five different types of equations may be used: (1) a domestic demand equation for the commodity in the importing country; (2) the marginal cost equation for the domestic industry; (3) an import demand equation for the commodity in the importing country; (4) the restraining countries' supply equations for exports of the commodity to the importing country; and (5) nonrestraining countries' supply equations of exports of the commodity to the importing country.

1/ Each of the following works has a statistical model of the steel industry:
(1) Crandall, op. cit.
(2) C. I. Higgins, "An Econometric Description of the U.S. Steel Industry," in Essays in Industrial Econometrics, edited by L. R. Klein, Wharton School, Philadelphia, 1972.
(3) MacPhee, op. cit.
(4) Jondrow, op. cit.
(5) Takacs, op. cit.

Assumptions for market structures are different in these models. MacPhee implicitly assumed a perfectly competitive steel market. Takacs explicitly assumed a monopolistic steel market. This study assumed a price-searchers' market of the steel industry, which is between perfect competition and monopoly.

2/ A. M. Adelman, "Steel, Administered Prices and Inflations," Quarterly Journal of Economics, Vol. CXXV, February 1964, pp. 16-40.

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The domestic demand equation.--The demand for steel is indirectly derived from the demand for both consumer and producer products. The gross national product (GNP) is a proper income variable to explain the demand for both types of products. Own prices as well as substitute prices are traditional variables included in a demand equation. Since some nonferrous metals can be used as substitutes for steel, their prices may have an effect on the demand.

It is assumed that relationships between the demand for steel mill products and each of its determinants can be approximated by a straight line. The equation used to explain the demand is specified in the following form:

$$X_t = B_{10} + B_{11}(Y/P^G)_t + B_{12}\,(P^D/P^G)_t + B_{13}(P^S/P^G)_t + u_{1t} \qquad (B.1A)$$

Where: X = apparent consumption of steel mill products in the United States (millions of net tons). 1/

Y = GNP index.

P^G = GNP deflator.

P^D = average domestic price of steel mill products (dollars per net ton).

P^S = price index for nonferrous metals.

u = disturbance term.

B_{10}, B_{11}, B_{12}, and B_{13}, are parameters to be estimated.

Import demand equation.--The main use of an import demand function is to evaluate the effect of the VRA's on levels of imports. As in the total demand function (B.1A), income and price are the two main independent variables in an import demand equation. The income variable (Y), measuring the level of the real GNP in equation B.1A, can be used to explain changes in the demand for imported steel products.

A single relative price variable is included in this equation. Looking at the commodity from the point of view of its users, the imports can be either a perfect or imperfect substitute for a domestically produced commodity. As intermediate goods or raw materials, primary steel products are homogeneous goods. For instance, nail producers use either domestically produced or foreign made wire rods as input for production. The main factor producers would consider in determining whether to buy their input domestically is the relative prices. If imports and domestically produced steel mill products were perfect substitutes, transaction costs and transportation costs were zero, and full market information were free and available, then the "law of one price" would hold and the use of either the

1/ As used here, apparent consumption = domestic shipments + imports - exports.

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domestic price or the import price would be sufficient. 1/ Obviously, this is not true in the steel industry. Higgins pointed out substantial price differences between foreign and U.S. steel firms. 2/ A trend variable was used to capture the change in U.S. buyers' demand that was not explained by the income and price variables over the sample period (1950-1974).

The import demand function for steel mill products is then formed as:

$$M_t = B_{20} + B_{21}(Y/P^G)_t + B_{22}(P^D/P^M)_t + B_{23}T + u_{2t} \qquad (B.2A)$$

Where: M = U.S. imports of steel mill products (millions of net tons).

P^M = the unit value of U.S. imports of steel mill products.

T = time trend.

The total cost function.--The structure of the costs in the steel industry differs from that in many other industries in the proportions of fixed costs to variable costs. Fixed costs of the industry are a large proportion of the total cost because capital expenditures are large. It is assumed there exists an aggregate marginal cost function for the steel industry. This assumption provides one marginal cost for the industry as a whole. 3/

In a price-searchers' market situation the marginal cost function cannot be estimated directly because the required cost data of individual firms are not available. However, it can be estimated through the total cost function. The total cost data are available, and the total cost function can be estimated directly. The first derivative of the estimated total cost function with respect to output may be used as the estimated marginal cost function. 4/

The total cost function depends on technological conditions and input supply conditions. It is independent of the state of the market for output. It is believed that the steel industry operates under conditions of declining marginal costs. Most estimated cost functions are in a quadratic form, implying either increasing or decreasing marginal costs.

1/ Under price-takers' market and perfect substitution between the domestically produced and imported goods, the "law of one price" prevails. This implies that the price of the imported commodities would be the same as the domestically produced ones.

2/ Higgins, op. cit.

3/ It is assumed that firms and the industry have identical marginal cost curves. There is no problem of aggregating. Although each firm could have different labor, equipment, and operating efficiencies, the differences in the marginal cost among firms are negligible.

4/ The total cost function is a definite integral of the marginal cost function, which has been assumed to exist. The method that was used to estimate a marginal cost function from an estimated total cost function was developed by Takacs in her steel model. This study used her method to estimate the marginal cost function (B.3C).

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A quadratic function is used for the total cost equation for steel:

$$C_t = B_{30} + B_{31}Q_t + B_{32}Q_t^2 + B_{33}Q_tW_t + B_{34}Q_tP_t^o + B_{35}Q_tP_t^c + u_{3t} \quad (B.3A)$$

Where: C = the total costs of the U.S. steel industry (billions of dollars).

Q = net shipments of steel products by U.S. firms (millions of net tons).

W = the average hourly earnings in the U.S. steel industry (dollars).

P^c = the wholesale price index for iron ore (1967=100).

P^o = the wholesale price index for coal (1967=100).

Foreign export supply functions.--The supply of steel for export will depend on the world price and factors which influence the domestic demand and supply of steel within the exporting countries. One main factor affecting levels of export supply is the excess capacity of foreign suppliers. A foreign firm with a low rate of capacity utilization would be expected to try harder to export its products than a firm selling its full capacity output at home. A positive relation between the volume of exports and the excess capacity in the restraining country is hypothesized.

Unlike import quotas, which restrict the goods from all foreign sources, the VRA's only apply to a single exporting country or a group of countries. In examining the impact of the VRA's in the steel industry, separate export supply functions should be estimated for the restraining countries and for the nonrestraining countries if the required data are available. These estimates are complicated by the shift of the United Kingdom from the nonrestraining to the restraining group as of 1972. Therefore, export supply functions should be estimated for four groups of countries: the restraining countries excluding the United Kingdom; the restraining countries including the United Kingdom; the nonrestraining countries including the United Kingdom; and the nonrestraining countries excluding the United Kingdom. 1/ With these four export supply functions, the annual impact of the VRA's can be estimated more accurately than those derived from a single function or the two functions that do not adjust the shift by the United Kingdom.

1/ During the period 1969 to 1971 the restraining countries included Belgium, France, Italy, Japan, Luxembourg, Netherlands, and West Germany. The most important nonrestraining countries included Austria, Canada, Mexico, Poland, Spain, Sweden, and the United Kingdom.

The four export supply equations are in the following forms:

$$E_t^{R1} = B_{40} + B_{41}(P^M/\sum_{i=1}^{7} W_i P_i^{\$} P_i^R)_t + B_{42}\, S_t^{R1} + u_{4t} \qquad \text{(B.4A)}$$

$$E_t^{R2} = B_{50} + B_{51}(P^M/\sum_{i=1}^{8} W_i P_i^{\$} P_i^R)_t + B_{52}\, S_t^{R2} + u_{5t} \qquad \text{(B.5A)}$$

$$E_t^{N1} = B_{60} + B_{61}(P^M/\sum_{i=1}^{5} W_i P_i^{\$} P_i^F)_t + B_{62}\, S_t^{N1} + u_{6t} \qquad \text{(B.6A)}$$

$$E_t^{N2} = B_{70} + B_{71}(P^M/\sum_{i=1}^{4} W_i P_i^{\$} P_i^F)_t + B_{72}\, S_t^{N2} + u_{7t} \qquad \text{(B.7A)}$$

where: E^{R1} = the quantity of steel mill products exported to the United States by the restraining countries excluding the United Kingdom (millions of net tons).

E^{R2} = the quantity of steel mill products exported to the United States by the restraining countries including the United Kingdom (millions of net tons).

E^{N1} = the quantity of steel mill products exported to the United States by the nonrestraining countries including the United Kingdom (millions of net tons).

E^{N2} = the quantity of steel mill products exported to the United States by the nonrestraining countries excluding the United Kingdom (millions of net tons).

P^M = the unit value of U.S. imports of steel mill products (dollars per net ton).

S^{R1} = the composite excess capacity in the restraining countries not including the United Kingdom (millions of net tons).

S^{R2} = the composite excess capacity in the restraining countries including the United Kingdom (millions of net tons).

S^{N1} = the composite excess capacity in the most important non-restraining countries, including the United Kingdom (millions of net tons).

S^{N2} = the composite excess capacity in the most important non-restraining countries, excluding the United Kingdom (millions of net tons).

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W_i = market share of the ith country ($\Sigma W_i = 1$).

$P_i^{\$}$ = annual exchange rate index for the currency of the ith country and U.S. dollars.

P_i^R = general price index of GNP of ith restraining country (seven restraining countries were included).

P_i^F = general price index of GNP of ith nonrestraining countries (only Austria, Canada, Poland, Sweden and United Kingdom were included).

$\Sigma W_i P_i^S P_i^R$ = weighted price deflator for restraining countries.

$\Sigma W_i P_i^S P_i^F$ = weighted price deflator for nonrestraining countries.

The empirical results and explanations

Unless otherwise stated, all equations were estimated by employing the method of ordinary least squares (OLS). The data used to fit the equations are annual observations, covering a period between 1950 and 1974. The estimates of parameters in each of the above specified equations are presented in the following part. When practicable, the estimates were compared with those that resulted from previous studies. The numbers in parentheses under the estimated parameters are the values of the t ratios; D.W. is the Durbin-Watson statistic; R^2 is the coefficient of determination; and F is the F ratio. 1/.

1/ The t test is used to show statistical significance or dependability of a single coefficient while the F test is used for testing the significance or dependability of an estimated equation. The D.W. test is used for testing existence of serially correlated disturbances. R^2 shows the fitness of the regression. For details of these tests, see L. R. Klein's A Textbook of the Econometrics, N.J. Prentice Hall, 1974.

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Domestic demand function.---The estimation resulted in the following demand equation:

$$X = 7.2513 + 0.0764(Y/P^G)_t - 0.3472(P^D/P^G)_t + 0.5182(P^S/P^G)_t \quad (B.1B)$$
$$(0.3221)(14.7889) \qquad (-2.3275) \qquad (4.0456)$$

$R^2 = 0.9003$ D.W. = 1.9629 F(3,20) = 55.4290 1/

All estimated coefficients have the expected signs and are statistically significant to the 0.01 level. The R^2 suggests that over 90 percent of the variation in the demand for steel is explained by the three independent variables. The Durbin-Watson statistic does not show that serially correlated disturbances exist. The F ratio denotes a highly significant regression.

The income coefficient, as expected, indicates that income has a positive effect on the quantity demanded of steel. The calculated income elasticity is 0.14. 2/ This means that a 10-percent increase in the real GNP would induce a 1.4-percent increase in the demand for steel. 3/

Derived from the coefficient of the domestic price variable, the price elasticity of the demand is -0.48. The price elasticity is close to the one estimated by the U.S. Steel Corporation in 1940, despite the difference in sample periods. In 1940, a U.S. Steel Corporation research group concluded that the best estimate of the elasticity of demand for steel would be approximately -0.3 or -0.4. 4/ The elasticity is also close to Crandall's recent estimate of the own-price elasticity for hot-rolled steel (-0.54). The above price elasticities show that the demand for steel is inelastic.

The calculated cross-price elasticity is 0.64. This means that a 10-percent increase in the substitute price would cause a 6.4-percent change in the quantity of steel demanded. The values of the two price elasticities are very close. The assumption that nonferrous metals are substitutable for steel is supported by statistical results.

1/ With (3,20) degrees of freedom, the F ratio is greater than 4.94 (the critical value at 1% level of significance), so that the regression is highly significant. Unless stated otherwise, all F tests of this study are significant to the 0.01 level or better.

2/ The income elasticity was computed by using the marginal income coefficient (0.0764) and the mean values of X and (Y/P^G).

3/ In basic economics, a change in demand means a shift of a demand schedule, while a change in quantity demanded means a move along the same demand schedule. While this standard is not strictly followed here, the meaning should be clear from the context. As shown in equation B.1A, the proxy that was used for domestic demand was apparent domestic consumption.

4/ H. Gregg Lewis, "A Statistical Analysis of the Demand for Steel, 1919," in Temporary National Economic Committee, Investigation of Concentration of Economic Powers, Washington, D. C., 1940, pp. 13913-13942.

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Import demand function.--Regressing the volume of imported steel on the three independent variables resulted in the following estimated coefficients:

$$M_t = -41.1084 + 0.3778\,(Y/P^G)_t + (4.0577(P^D/P^M)_t - 1.3250T \qquad (B.2B)$$
$$(-7.6750)\quad (7.7522)\qquad\qquad (7.7522)\qquad (-4.8278)$$

$R^2 = 0.9440$ D.W. = 1.5389 F(3,15) = 84.3626

All the estimated coefficients have the right signs and are statistically significant to the 0.05 level or better. The magnitudes of the R^2 and the F ratio are very high and the Durbin-Watson statistic does not indicate there is a problem with autocorrelations. The positive sign of the relative price variable indicates that the imports will increase in response to an increase in the domestic price or a decrease in the import price.

The price and income elasticities play an important role in determining international trade flows. There are numerous statistical estimates of import demand elasticities for the United States; a few of these estimates are for steel, and several more apply to broader commodity groups in which steel is an important item. These import demand elasticities vary substantially due to differences in grouping, sample periods, and definitions of the price variable. The value of the import demand elasticity, which was derived from the estimated coefficient of the relative price variable and the mean values of imports and the relative price, is 0.70. The marginal propensity to import is about 0.38. It suggests that a 1-unit increase in the real GNP would induce a 0.38-unit increase in steel imports.

In 1974, C. R. MacPhee developed an import demand model in order to investigate the influence of nontariff restrictions on international steel trade. 1/ He estimated U.S. import demand for steel as a function of the relative prices, U.S. real GNP, and capacity utilization. He defined his relative price variable as the ratio of the import price index to the domestic price index of steel with a sample period from 1954 to 1968. His estimated relative price elasticity is -0.932.

Cost functions.--Based on the form specified in equation B.1A, the total cost function was estimated by OLS and the Cochrane-Orcutt iterative technique (COI). 2/ The estimated coefficients are shown in the following equation:

$$C_t = 1.6775 + 0.0228466Q_t - 0.00014487Q_t^2 + 0.0230139Q_tW_t$$
$$(0.6444)\quad (0.3532)\qquad (-0.3451)\qquad (11.0215)$$

$$+ 0.00015353Q_tP_t^C + 0.0006054Q_tP_t^O \qquad (B.3B)$$
$$(3.0012)\qquad\qquad (3.5853)$$

$R^2 = 0.9955$ D.W. = 1.7231 F(5,18) = 733.8710

The value of R^2 is extremely high. All coefficients have the expected signs. All coefficients are significant to the 0.10 level or better except for the two quantity variables. Because the coefficients on the quantity

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1/ MacPhee, op. cit. p. 75.

2/ The Cochrane-Orcutt iterative technique was used in estimating the total cost equation. The first order serial coefficient is 0.18.

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variables are small and insignificant, it appears there are nearly constant returns to scale.

From the estimated total cost function, the marginal cost function can be derived. By differentiating the estimated total cost function with respect to the output level and adjusting the units involved to get the marginal cost per thousand tons of steel output, the marginal cost turned out to be as follows:

$$MC_t = 22.8466 - 0.2897Q_t + 23.0139W_t + 0.1535P_t^C + 0.6054P_t^O \quad (B.3C)$$

The negative coefficient of the quantity variable Q in the estimated marginal cost function implies that an increase in output would result in a reduction in the marginal cost. The marginal cost per net tons would decrease by only about 28.97 cents as output increases by 1 million tons, which amounts to nearly constant returns to scale.

Although most total cost functions are in a quadratic form, there are a few still in the linear form. Using unpublished, proprietary information, Yntema specified linear total cost equations for the U.S. Steel Corporation and estimated them with the annual data from 1927 through 1938. 1/ Imposition of the linear limitation on total cost functions means the assumption of constant marginal costs. For instance, if the total cost equation (B.3B) is linear, the second term on the right-hand side of the marginal cost equation (B.3C) will disappear after differentiation. It is a constant and remains the same in spite of changes in output. The above results do not provide significant evidence that returns to scale are not constant. But, Yntema also assumed that the marginal cost is not affected by nominal input prices. Therefore, Yntema's results are limited in usefulness for comparison with the above cost functions.

Foreign export supply functions.--The explanation of the changes in the level of foreign exports is crucial in the analysis of the VRA's effects. Four foreign export supply functions were estimated for this purpose. Two of the equations for the restraining countries were estimated for the period in which the countries included in the group were not imposing a VRA on their exports of steel to the United States (B.4A and B.5A). The export supply equation for the group of nonrestraining countries including the United Kingdom (B.6A) was estimated using the sample period 1953 through 1971, which was the year before the United Kingdom joined the VRA agreement. The export equation (B.7A) for the nonrestraining countries excluding the United Kingdom was estimated with 21 observations (1953 to 1973). The estimated coefficients are shown in the following equations:

$$E_t^{R1} = \underset{(-2.2611)}{-5.3678} + \underset{(1.9752)}{0.0278}\left(P_t^M / \sum_{i=1}^{7} W_i P_i^{\$} P_i^R\right) + \underset{(7.8791)}{0.3316} S_t^{R1} \quad (B.4B)$$

$$R^2 = 0.8017 \qquad D.W. = 1.9509 \qquad F(2,12) = 32.6307$$

$$E_t^{R2} = \underset{(-2.1632)}{-6.6733} + \underset{(6.7722)}{0.0311}\left(P_t^M / \sum_{i=1}^{8} W_i P_i^{\$} P_i^R\right)_t + \underset{(6.7722)}{0.3369} S_t^{R2} \quad (B.5B)$$

$$R^2 = 0.7570 \qquad D.W. = 1.5278 \qquad F(2,12) = 24.2529$$

1/ T. O. Yntema, "An Analysis of Steel Prices, Volume and Costs Controlling Limitations on Price Reductions," in Temporary National Economic Committee, Investigation of Concentration of Economic Powers, Washington, D.C., 1940, pp. 14032-14094.

$$E_t^{N1} = -4.0629 + 0.0307P_t^M + 0.1977S_t^{N1} \qquad (B.6B)\ \underline{1}/$$
$$(-2.1238)\ (2.0573)\quad (4.9130)$$

$R^2 = 0.6181$ D.W. = 1.0875 F(2,16) = 18.5520

$$E_t^{N2} = -2.4831 + 0.0185P_t^M + 0.2645S_t^{N2} \qquad (B.7B)$$
$$(-3.9993)\ (3.6196)\quad (7.3347)$$

$R^2 = 0.8276$ D.W. = 1.9484 F(2,18) = 32.2825

All of the coefficients in the four export supply equations have the expected signs. All coefficients of determination are acceptable. Coefficients of all variables are significant to the 0.05 level or better.

The four coefficients of the price variables denote relationships between volumes of exports and changes in the prices. For instance, in equation B.4B, the price coefficient suggests that in response to a dollar increase in the real price of steel, firms in the restraining countries would increase their supply to the United States by 27,800 net tons. The price elasticities of the foreign supply of steel mill products can also be derived from these four estimated coefficients. The calculated supply elasticities are 0.75, 0.03, 0.71 and 0.43 for the restraining countries without the United Kingdom,

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1/ Data required to form the weighted price deflator for nonrestraint countries are incomplete. Instead, a simple average price deflator was included in the nonrestraining supply functions, producing the following estimates:

$$E_t^{N1} = 4.9566 - 0.0326\left(P^M/\frac{1}{5}\sum_{i=1}^{5}P_i^{\$}P_i^F\right)_t + 0.0545S_t^{N1}$$
$$(2.9168)(-3.1055)$$
$R^2 = 0.6987$ D.W. = 1.1432

$$E_t^{N2} = -0.3662 - 0.0011\left(P^M/\frac{1}{4}\sum_{i=1}^{4}P_i^{\$}P_i^F\right)_t + 0.3186S_t^{N2}$$
$$(-0.4185)(-0.2552)\qquad (6.7511)$$
$R^2 = 0.7726$ D.W. = 1.7264

Price coefficients in both equations have a negative sign, indicating a situation which is inconsistent with the law of supply. Thus, the undeflated price variable is used.

the restraining countries with the United Kingdom, the nonrestraining countries with the United Kingdom, and the nonrestraining countries without the United Kingdom, respectively. According to the sample data, 80.6 percent of total U.S. steel imports were supplied by the restraining countries including the United Kingdom.

The magnitudes and t-ratios of the coefficients of the excess capacity variables in these estimated export supply equations jointly suggest that excess capacity plays a dominant role in determining the quantity of exports supplied. On the average, about one-quarter of the increased excess capacity was used to produce products for U.S. consumption.

In general, the empirical results of the above equations fall within acceptable ranges. All regressions are highly significant and dependable, as shown by the F ratios. The results support the theoretical expectations stated in appendix A. In addition, they are capable of simulating the impact of the VRA's.

Mathematical derivation of formulas and calculation

The following formulas are mainly based on the graphical models expressed in figure A.4 (app. A). It is assumed that the domestic industry is under a price-searchers' market. First, the equation system for free trade is presented and solved for the values of the variables under free trade. Second, the equation systems for the conditions under the voluntary export restraint is presented and solved for values of the variables under the voluntary export restraint. Finally, the free trade and voluntary export restraint regimes are compared by subtracting the expression for the value of each variable under free trade from the expression for the value of that variable under the voluntary export restraint.

Free trade system.—The equation system for a price-searchers' market under free trade is given by the following equations:

(1) $D = a_1 + bP^D$ Total demand function.

(2) $D^R = D - E_B - E_C$ Remaining demand curve.

(3) $MC = a_2 + cQ$ Marginal cost curve.

(4) $MC = MR$ Profit maximization condition. 1/

(5) $P^D = P^W$ Assumption of price equalization.

(6) $Q = D^R$ Equilibrium condition.

(7) $E_B = a_3 + dP^W$ Export supply function of country B.

(8) $E_C = a_4 + eP^W$ Export supply function of country C. 2/

1/ It is assumed that all producers and the industry have identical marginal cost curves and the same price elasticity of demand. These two assumptions are sufficient for theoretical considerations, but not necessary for the purpose of estimating.

2/ According to the laws of supply and demand, the value of b is negative, and the values of d and e are positive. The value of the intercept of the demand function, a_1, is positive.

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(9) $M = E_B + E_C$ Total imports.

Where:

D = Quantity of the commodity demanded or consumed domestically in the importing country.

P^D = Price of the commodity in the domestic market of the importing country.

D^R = Remaining domestic demand (quantity demanded minus imports).

E_B = Quantity of exports from country B. 1/

E_C = Quantity of exports from country C.

MC = Marginal cost of domestic industry.

Q = Quantity produced in the importing country.

MR = Marginal revenue of domestic industry.

P^W = World market price (import price) of the good.

M = Quantity of imports into the importing country.

The superscripts F and V are used to refer to the values of the variables under free trade and voluntary export restraint conditions, respectively.

From the system, the marginal revenue curve associated with the remaining demand can be derived. By using equations (1), (2), (5), (7), and (8), the value of the slope of the remaining demand curve can be defined. The value of the slope of the associated marginals revenue curve can be determined from the slope of the remaining demand curve. The MR can be expressed in the following form:

$$(10)\quad MR = \frac{2}{b - d - e} D^R - \frac{a_1 - a_2 - a_3}{b - d - e}$$

Equations (1) through (6) and (10) can be used to solve for the equilibrium value of domestic production under free trade, Q^F.

$$(11)\quad Q^F = \frac{a_2(b - d - e) + a_1 - a_3 - a_4}{2 - c(b - d - e)}$$

1/ Country B becomes the restraining country under the voluntary export restraint; country C is not subject to the restriction.

It is assumed that under free trade, world price equals domestic price. Equation (11) can be used with equations (1), (2), (7), and (8) to derive an expression for domestic price under free trade:

$$(12)\quad P^{DF} = \frac{a_2 + \left(c - \frac{1}{b - d - e}\right)(a_1 - a_3 - a_4)}{2 - c(b - d - e)}$$

By substituting equation (12) into the demand function, the level of domestic demand under free trade can be found in terms of constants and estimated coefficients:

$$(13)\quad D^F = a_1 + b\left[\frac{a_2 + \left(c - \frac{1}{b - d - e}\right)(a_1 - a_3 - a_4)}{2 - c(b - d - e)}\right]$$

The quantity of the good imported is equal to the difference between the quantity consumed and the quantity produced in the domestic economy. Subtracting equation (11) from equation (13) and simplifying results in the quantity of the imports under free trade:

$$(14)\quad M^F = a_1 + \frac{a_2(d + e) + b\left(c - \frac{1}{b - d - e} - \frac{1}{b}\right)(a_1 - a_3 - a_4)}{2 - c(b - d - e)}$$

Voluntary export restraint system.--The equation system for a price-searchers' market under imposition of the voluntary export restraint is given by the following equations:

$$(15)\quad D = a_1 + bP^D$$

$$(16)\quad D^R = D - E_B - E_C$$

$$(17)\quad MC = a_2 + cQ$$

$$(18)\quad MR = MC$$

$$(19)\quad Q = D^R$$

$$(20)\quad E_B = \bar{E}_B$$

$$(21)\quad E_C = a_4 + eP^M$$

$$(22)\quad M = E_B + E_C$$

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The endogenous variables are the same as in the case of free trade. The only change as compared with the system under free trade is equation (20). 1/ When the voluntary export restraint is binding, exports will be at ceiling level, $\bar{E}_B$. The quantity of exports from country B differs from that under free trade. The remaining domestic demand is affected by the change in exports of country B. In turn, the marginal revenue curve associated with the remaining demand curve is also changed. By substituting and transferring, the marginal revenue curve under voluntary export restraint can be expressed by the following equation:

$$(23)\quad MR = \frac{2}{b - e} D^R - \frac{\bar{E}_B + a_4 - a_1}{b - e}$$

By following the same procedures used under free trade, the profit-maximizing output level (Q^V), domestic price (P^{DV}), the level of consumption in the domestic economy (D^V), and the level of imports (M^V) under the voluntary export restraint can be expressed by equations (24), (25), (26), and (27), respectively:

$$(24)\quad Q^V = \frac{a_2(b - e) - \bar{E} - a_4 + a_1}{2 - c(b - e)}$$

$$(25)\quad P^{DV} = \frac{a_2 + (c - \frac{1}{b - e})(a_1 - \bar{E}_B - a_4)}{2 - c(b - e)}$$

$$(26)\quad D^V = a_1 + b\left[\frac{a_2 + (c - \frac{1}{b - e})(a_1 - a_3 - a_4)}{2 - c(b - d - e)}\right]$$

$$(27)\quad M^V = \frac{a_1 + [2 - c(b - e)] + a_2 e + b(c - \frac{1}{b - e} - \frac{1}{b})(a_1 - \bar{E}_B - a_4)}{2 - c(b - e)}$$

1/ The assumptions of identical MC curves and price elasticity under free trade system also hold under the restraint system.

If the VER is binding, the ceiling $\bar{E}_B$ will be lower than the free trade quantity of exports from country B, which is given by equation (28).

$$(28)\quad E_B^F = a_3 + d\,\frac{a_2 + (c - \frac{1}{b - d - e})\,(a_1 - a_3 - a_4)}{2 - c(b - d - e)}$$

The impact of the voluntary export restraint.--The four variables in which this study is interested are domestic output, domestic price, domestic consumption, and the level of imports of the restrained good. Expressions for the changes in these four variables resulting from the imposition of a voluntary export restraint can be derived by subtracting the expressions for the values of the variables under free trade from their corresponding expressions under the voluntary export restraint.

The changes in domestic output ($\Delta Q = Q^V - Q^F$), domestic price ($\Delta P = P^{DV} - P^{DF}$), domestic consumption ($\Delta D = D^V - D^F$), and the quantity of imports ($\Delta M = M^V - M^F$) attributable to the restraint can be expressed as follows:

$$(29)\ \Delta Q = \frac{1}{2 - c(b - e)}\,(E_B^F - \bar{E}_B) + \frac{d(a_2 + \frac{a_2 - a_3 - a_4}{b - d - e})}{[2 - c(b - e)]\,[2 - c(b - d - e)]}$$

$$(30)\ \Delta P = \frac{c - \frac{1}{b - e}}{2 - g(b - f)}\,(E_B^F - \bar{E}_B) + \frac{\frac{b}{b - e}(a_2 + \frac{a_1 - a_3 - a_4}{b - d - e})}{[2 - c(b - e)]\,[2 - c(c - d - e)]}$$

$$(31)\ \Delta D = a_1 + bP^{DV} - a_1 - bP^{DF} = b(P^{DV} - P^{DF})$$

$$(32)\ \Delta M = \frac{(c - \frac{1}{b - e} - \frac{1}{b})}{2 - c(b - e)}\,(E_B^F - \bar{E}_B) + \frac{d(\frac{b}{b - e} - 1)\,(a_2 + \frac{a_1 - a_3 - a_4}{b - d - e})}{[2 - c(b - d)]\,[(2 - c(b - d - e)]}$$

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Procedures for calculation.--The estimates of effects of the VRA's on steel mill products presented in chapter 2 were calculated by using the estimated coefficients of the statistical steel model and equations (29) through (32).

The first step was to calculate the values of a_1, a_2, a_3, and a_4. They are the intercepts of the domestic demand, marginal cost, and foreign supply equations in the price-quantity plane. Their values were calculated for each year of the 6-year period by substituting the observed values of the variables other than price and quantity into the estimated equations. For instance, the values of a_1, a_2, a_3, and a_4 in 1969 were calculated in the following ways:

$$a_{1,1969} = 7.2513 + 0.0764(Y/P^G)_{1969} + 0.5182(P^S/P^G)_{1969} \quad \text{(from B.1B)}$$

$$a_{2,\,1969} = 22.8466 + 23.0139W_{1969} + 0.1535P^c_{1969} + 0.6054P^o_{1969} \quad \text{(from B.3C)}$$

$$a_{3,\,1969} = -5.3678 + 0.3316S^{R1}_{1969} \quad \text{(from B.4B)}$$

$$a_{4,\,1969} = -4.0629 + 0.1977S^{N1}_{1969} \quad \text{(from B.6B)}$$

The intercepts a_1 and a_2 remained unchanged for the 6-year period. Since the United Kingdom shifted from the nonrestraining to the restraining group in 1972, the intercepts a_3 and a_4 were calculated by equations B.5B and B.7B for 1972 through 1974:

$$a_{3,\,1972} = -6.6733 + 0.3369S^{R2}_{1972} \quad \text{(from B.5B)}$$

$$a_{4,\,1972} = -2.4831 + 0.2645S^{N2}_{1972} \quad \text{(from B.7B)}$$

The second step was to determine the values of other parameters, b, c, d, and e. Their values can be found in the estimated equations in this appendix.

$b = B_{11} = -0.3472$ (from B.1B; for 1969 through 1974)

$c = 0.2897$ (from B.3C; for 1969 through 1974)

$d = B_{41} = 0.0278$ (from B.4B; for 1969 through 1971)

$d = B_{51} = 0.0311$ (from B.5B; for 1972 through 1974)

$e = B_{61} = 0.0307$ (from B.6B; for 1969 through 1971)

$e = B_{71} = 0.0185$ (from B.8B; for 1972 through 1974)

The third and final step was to substitute these calculated and estimated coefficients into equations (28), and (29) through (32), and solve them. The solutions to these equations or formulas were estimates of the changes in the four variables attributed to the imposition of the VRA's.

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Values of Variables and Sources of Data

There were 19 continuous variables included in the steel model. Values of these variables and sources of data are given in the following tables.

Table B-1.--Steel mill products: Domestic shipments, exports, imports, and apparent domestic consumption, 1950-74

Year	Domestic shipments	Imports	Exports	Apparent domestic consumption	Ratio of imports to domestic consumption
	1,000 net tons				(in percent)
1950	66,400	1,014	2,639	70,053	1.5
1951	71,000	2,177	3,051	76,228	2.9
1952	63,200	1,183	3,918	68,301	1.7
1953	74,600	1,670	2,907	79,177	2.1
1954	58,700	770	2,659	62,129	1.2
1955	78,800	973	4,061	83,834	1.2
1956	77,400	1,339	4,348	83,087	1.6
1957	74,300	1,153	5,348	80,801	1.4
1958	56,000	1,705	2,823	60,528	2.8
1959	64,500	4,394	1,677	70,571	6.2
1960	67,200	3,359	2,977	73,536	4.6
1961	62,500	2,163	1,990	67,653	4.7
1962	70,600	4,100	2,013	76,713	5.3
1963	75,600	5,452	2,224	83,276	6.6
1964	84,900	6,440	3,442	94,782	6.8
1965	92,700	10,383	2,496	105,579	9.8
1966	89,995	10,753	1,723	102,471	10.5
1967	83,897	11,455	1,685	97,037	11.8
1968	91,856	17,959	2,170	111,985	16.0
1969	93,877	14,034	5,229	113,140	12.4
1970	90,798	13,364	7,062	111,224	12.0
1971	87,038	18,304	2,827	108,169	16.9
1972	91,805	17,681	2,873	112,359	16.7
1973	111,430	15,150	4,052	130,632	11.6
1974	109,472	15,970	5,033	130,475	12.2

Source: American Iron and Steel Institute, Annual Statistical Report, various issues.

Note: 1. More recently published data were used when data differed in different annual reports. This method was used for all tables in appendices B., C. and D.

2. Apparent domestic consumption was the demand variable D.

3. Domestic shipment was the variable Q.

4. Details may not add to totals because of rounding.

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Table B-2.--U.S. GNP indexes, steel scrap prices, and total costs of the U.S. steel industry, 1950-74

Year	Real GNP index	Scrap steel price	Domestic steel price	Total cost of U.S. steel industry	Implicit GNP deflator
	(1950 = 100)	(Long ton)	(Net ton)	(In billions of dollars)	(1950=100)
1950	100.00	$ 39.26	$100.50	8.77	100.0
1951	107.63	45.18	108.29	11.16	106.7
1952	113.64	44.00	110.66	10.31	109.1
1953	118.63	41.08	119.29	12.42	110.1
1954	117.77	29.83	124.87	9.96	111.7
1955	123.75	40.54	130.62	12.95	113.3
1956	126.79	53.50	141.79	14.15	117.2
1957	129.30	47.67	155.33	14.46	121.6
1958	130.29	38.00	160.74	11.76	124.7
1959	136.55	40.00	163.28	13.40	126.7
1960	140.07	33.00	163.11	13.41	128.8
1961	143.89	15.00	162.43	12.60	130.4
1962	151.27	29.00	162.09	13.41	131.9
1963	157.39	27.00	162.94	13.83	133.7
1964	165.83	35.00	164.29	15.36	135.7
1965	174.91	35.00	164.97	16.90	138.3
1966	184.41	31.00	167.34	17.21	142.0
1967	190.42	27.00	169.20	16.05	146.6
1968	199.48	27.00	173.43	17.68	152.5
1969	204.28	32.00	181.72	18.35	159.7
1970	204.82	42.00	193.40	18.83	170.7
1971	210.54	36.80	208.12	19.79	179.3
1972	222.16	38.00	220.64	21.78	186.7
1973	233.03	57.40	226.90	27.65	197.3
1974	230.54	104.20	287.64	28.79	214.6

Source: U.S. Department of Commerce and American Iron and Steel Institute.

Note: 1. Data used to calculate the real GNP index and the implicit GNP deflator were from Survey of Current Business, various issues.

2. Through 1957, the scrap steel price was Pittsburgh price of steel scrap No. 1 heavy melting, broker to consumer, f.o.b. Pittsburgh basing point. Beginning 1958, the price of scrap at Pittsburgh represents consumer's buying price. Data were from U.S. Department of Commerce, Business Statistics, and, Survey of Current Business, various issues.

3. Total costs of the U.S. steel industry included total employment costs, materials, supplies, freight and other services, charges for depreciation, depletion, interest and taxes. Original data were from American Iron and Steel Institute, Annual Statistical Report, various years, and were processed by W. E. Takacs.

4. Domestic price series was obtained by multiplying the Bureau of Labor Statistics' price index for steel mill products (1967=100) by the unit value of steel mill product shipments in 1967. Unit value data were from American Iron and Steel Institute, Annual Statistical Report, various years.

Table B-3.--Steel mill products: Wholesale price indexes for total steel mill products, nonferrous metals, iron ore and coal, and hourly wage, 1950-74

(1967=100)

Year	WPI steel	WPI nonferrous	WPI iron ore	WPI coal	Hourly labor wage
1950	59.4	64.4	77.8	83.3	$1.69
1951	64.0	76.8	83.5	85.1	1.92
1952	65.4	76.3	86.9	85.4	2.02
1953	70.5	77.3	97.1	88.5	2.19
1954	73.8	76.8	99.6	83.4	2.23
1955	77.2	88.3	101.3	82.3	2.41
1956	83.8	96.5	109.2	89.8	2.57
1957	91.8	85.0	114.7	97.6	2.73
1958	95.0	79.0	111.8	96.5	2.91
1959	96.5	84.2	107.2	96.2	3.10
1960	96.4	85.9	108.0	95.6	3.08
1961	96.0	83.0	109.1	94.6	3.20
1962	95.8	82.1	104.4	93.7	3.29
1963	96.3	82.0	103.6	93.8	3.36
1964	97.1	87.6	100.8	93.8	3.41
1965	97.5	95.3	100.7	93.4	3.46
1966	98.9	100.0	100.7	95.5	3.58
1967	100.0	100.0	100.0	100.0	3.62
1968	102.5	103.5	98.1	103.7	3.82
1969	107.4	113.5	98.1	112.6	4.09
1970	114.3	124.7	100.1	150.3	4.22
1971	123.0	116.0	103.0	181.8	4.57
1972	130.4	116.9	103.0	193.8	5.17
1973	134.1	135.0	106.7	222.5	5.61
1974	170.1	187.1	123.3	399.5	6.41

Source: U.S. Bureau of Labor Statistics and American Iron and Steel Institute Annual Statistical Report, various years.

Note.--Hourly wage was based on the average hourly earnings of production workers in the Blast Furnace and Steel Mill Product Industry (1972 SIC Code 3312).

Table B-4.--Steel mill products: U.S. imports by sources and unit values, 1950-74

Year	Total	Japan	ECSC	United Kingdom	Import unit value
	1,000 net tons				(Net ton)
1950	1,014	18	782	64	$ 75.4
1951	2,177	113	1,892	131	119.1
1952	1,183	181	859	36	148.5
1953	1,670	119	1,288	92	124.7
1954	770	24	672	41	103.8
1955	973	96	612	49	110.2
1956	1,339	48	1,070	63	129.7
1957	1,153	31	890	58	147.4
1958	1,705	250	1,201	85	113.2
1959	4,394	624	2,896	214	117.5
1960	3,359	601	2,091	211	133.6
1961	3,163	588	1,941	165	120.9
1962	4,100	1,072	2,087	250	118.1
1963	5,452	1,808	2,246	350	116.1
1964	6,440	2,446	2,585	285	116.3
1965	10,383	4,418	4,191	720	113.3
1966	10,753	4,851	3,841	748	112.3
1967	11,455	4,468	4,842	818	112.8
1968	17,959	7,294	7,097	1,302	110.0
1969	14,034	6,253	5,200	894	124.2
1970	13,364	5,935	4,753	824	147.0
1971	18,304	6,908	7,156	1,357	144.0
1972	17,681	6,440	6,522	1,257	158.0
1973	15,150	5,637	5,414	1,037	186.2
1974	15,970	6,159	5,814	610	320.4

Source: American Iron and Steel Institute, Annual Statistical Report, various years.

Note: 1. ECSC included Belgium, France, West Germany, Italy, Luxembourg, and Netherlands

2. The United Kingdom joined the restraining group in 1972.

3. The most important nonrestraining countries included Austria, Canada, Mexico, Poland, Spain, and Sweden.

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Table B-5.--Production of crude steel (ingots and steel for castings) of restraining countries, 1950-74

(In millions of metric tons)

Year	Belgium	France	West Germany (includes Saar)	Italy	Luxembourg	Netherlands	Japan	United Kingdom	Total
1950	3.8	8.6	14.0	2.4	2.4	.5	4.8	16.6	53.2
1951	5.1	9.8	16.1	3.1	3.1	.6	6.5	15.9	60.1
1952	5.1	10.9	18.6	3.5	3.0	.7	7.0	16.7	65.5
1953	4.5	10.0	18.1	3.5	2.6	.8	7.7	17.9	65.2
1954	5.0	10.6	20.2	4.2	2.8	.9	7.7	18.8	70.4
1955	5.9	12.5	24.5	5.4	3.2	1.0	9.4	20.1	82.1
1956	6.4	13.4	26.5	5.9	3.4	1.1	11.1	21.0	88.8
1957	6.3	14.1	27.9	6.8	3.5	1.2	12.6	22.0	94.4
1958	6.0	14.6	26.2	6.3	3.4	1.4	12.1	19.9	89.9
1959	6.4	15.2	29.4	6.7	3.7	1.7	16.6	20.5	100.3
1960	7.2	17.3	34.1	8.2	4.1	1.9	22.1	24.7	119.6
1961	7.0	17.5	33.4	9.1	4.1	1.9	28.3	22.4	123.9
1962	7.3	17.2	52.5	9.7	4.0	2.1	27.5	20.8	121.4
1963	7.5	17.5	31.6	10.1	4.0	2.3	31.5	22.9	127.6
1964	8.7	19.8	37.3	9.8	4.6	2.6	39.8	26.6	149.3
1965	9.2	19.6	36.8	12.7	4.6	3.1	41.2	27.4	154.6
1966	8.9	19.6	35.3	13.6	4.4	3.3	47.8	24.7	157.6
1967	9.7	19.6	36.7	15.9	4.5	3.4	62.2	24.3	176.3
1968	11.6	20.4	41.2	16.9	4.8	3.7	66.9	26.3	191.8
1969	12.8	22.5	45.3	16.4	5.5	4.7	82.2	26.8	216.3
1970	12.6	23.8	45.0	17.3	5.5	5.0	93.3	28.3	230.8
1971	12.4	22.8	40.3	17.4	5.2	5.1	88.6	24.2	216.1
1972	14.5	24.1	43.7	19.8	5.4	5.6	96.9	25.3	235.4
1973	15.5	25.3	49.5	21.0	5.9	5.6	119.3	26.6	268.8
1974	16.2	27.0	53.0	23.5	6.3	5.8	117.1	22.5	271.3

Source: Iron Age Magazine, Annual Statistical Review, 1973-74, and UN Quarterly Bulletin of Steel Statistics for Europe, 1950-72.

Table B-6.--Production of crude steel (ingots and steel for castings) of nonrestraining countries, 1950-74

(In millions of metric tons)

Year	Austria	Canada	Mexico	Poland	Spain	Sweden	Total
1950	.9	3.1	.3	2.5	.8	1.4	9.2
1951	1.0	3.2	.4	2.8	.8	1.5	9.9
1952	1.1	3.4	.5	3.2	.9	1.7	10.7
1953	1.3	3.7	.4	3.6	.9	1.8	11.8
1954	1.6	2.9	.5	4.0	1.1	1.9	11.9
1955	1.8	4.1	.5	4.4	1.2	2.1	14.3
1956	2.1	4.8	.5	5.0	1.2	2.4	16.1
1957	2.5	4.6	.6	5.3	1.3	2.5	16.9
1958	2.4	3.9	1.0	5.6	1.6	2.4	17.0
1959	2.5	5.5	1.3	6.2	1.8	2.9	20.0
1960	3.2	5.3	1.5	6.7	1.9	3.2	21.8
1961	3.1	5.8	1.7	7.2	2.3	3.6	23.7
1962	2.9	6.5	1.8	7.7	2.3	3.6	24.9
1963	2.0	7.3	2.0	8.0	2.5	3.9	26.6
1964	3.2	8.2	2.3	8.6	3.1	4.4	30.0
1965	3.2	9.1	2.4	9.1	3.5	4.7	32.2
1966	3.2	9.1	2.8	9.8	3.8	4.8	33.5
1967	3.0	8.8	3.0	10.4	4.5	4.8	34.5
1968	3.5	10.2	3.3	15.0	4.9	5.0	38.0
1969	3.9	9.4	3.5	11.3	5.9	5.3	39.3
1970	4.1	11.2	3.9	11.7	7.4	5.5	43.9
1971	3.9	11.0	3.8	12.7	8.0	5.3	44.8
1972	4.1	11.8	4.4	13.4	9.5	5.2	48.5
1973	4.2	13.5	4.7	14.1	10.8	5.7	53.0
1974	4.7	13.5	5.1	14.8	11.4	6.0	55.5

Source: Iron Age Magazine, Annual Statistical Review, various issues.

Table B-7.--Effective capacity of restraining countries for the production of crude steel, 1955-74

(In millions of net tons)

Year	France	Germany	Italy	Belgium	Luxem-bourg	Nether-lands	United Kingdom	Japan
1955	16.8	22.0	5.7	6.3	3.3	1.0	20.1	10.1
1956	17.3	23.5	6.2	6.7	3.4	1.1	21.6	13.2
1957	18.4	25.7	7.4	7.1	3.5	1.3	22.8	16.3
1958	19.1	27.6	7.9	7.5	3.6	1.5	23.8	17.5
1959	16.2	33.1	8.0	7.6	3.9	1.7	24.9	18.6
1960	17.3	34.3	8.6	8.1	3.9	2.1	26.2	28.2
1961	18.8	36.5	9.4	8.3	4.2	2.2	26.9	32.2
1962	19.5	38.1	10.1	8.4	4.3	2.5	28.2	37.5
1963	20.9	39.7	11.0	8.8	4.5	2.9	29.3	43.7
1964	21.9	40.4	11.6	10.0	4.5	3.3	29.9	47.5
1965	22.7	45.5	15.0	10.5	4.9	3.5	31.5	53.3
1966	23.5	47.6	17.5	11.1	5.2	3.5	31.3	56.1
1967	23.8	47.8	19.2	12.4	5.7	3.5	31.7	78.5
1968	24.3	48.6	19.6	13.3	5.7	3.8	32.0	87.2
1969	24.7	50.6	20.2	14.3	5.9	4.9	28.5	103.2
1970	26.0	54.5	21.3	14.7	6.0	5.1	29.7	114.6
1971	28.0	57.6	22.8	16.5	6.1	6.3	30.3	119.2
1972	27.6	59.0	25.3	16.7	6.2	6.8	31.0	123.7
1973	28.8	59.1	27.6	17.2	6.5	7.0	29.8	139.0
1974	32.3	61.7	29.6	18.1	6.6	7.4	33.1	150.8

Source: Special Committee for Iron and Steel, OECD, The Iron and Steel Industry, various issues.

Table B-8.--Effective capacity of some nonrestraining countries for the production of crude steel, 1955-74

(In millions of net tons)

Year	Sweden	Spain	Canada	Austria
1955	2.3	-	4.7	1.8
1956	2.6	-	5.0	2.1
1957	2.8	-	5.3	2.5
1958	2.9	2.6	5.7	2.6
1959	3.1	3.0	6.1	2.7
1960	3.2	3.1	6.6	3.2
1961	3.7	3.3	7.1	3.2
1962	4.0	3.4	7.5	3.2
1963	4.3	3.6	7.8	3.2
1964	4.4	3.8	8.6	3.4
1965	4.8	4.7	9.7	3.5
1966	5.2	4.8	10.7	3.5
1967	5.3	6.2	11.0	3.5
1968	5.5	7.0	11.7	4.0
1969	5.7	8.8	11.9	4.0
1970	6.0	9.5	12.0	4.0
1971	6.1	10.1	12.8	4.0
1972	6.1	11.1	13.6	4.0
1973	6.4	10.9	14.0	4.7
1974	6.9	11.5	14.8	5.0

Source: Same as those of the restraint countries.

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Table B-9.--Steel mill products: Excess capacities of restraining and nonrestraining countries, 1953-74

(In millions of net tons)

Year	Excess capacity of restraining countries excluding the United Kingdom	Excess capacity of restraining countries including the United Kingdom	Excess capacity of nonrestraining countries including the United Kingdom	Excess capacity of nonrestraining countries excluding the United Kingdom
1953	11.79	14.87	5.65	2.57
1954	9.81	12.34	6.87	3.84
1955	3.42	3.42	1.06	1.06
1956	3.86	4.74	1.68	0.80
1957	8.04	8.93	2.69	1.81
1958	16.19	20.60	8.98	4.58
1959	10.46	15.31	7.57	2.72
1960	8.15	10.02	4.20	2.32
1961	11.13	16.08	8.19	3.23
1962	22.04	30.08	12.60	4.56
1963	29.75	36.81	11.97	4.82
1964	18.07	21.59	5.97	2.44
1965	30.96	35.48	8.72	4.20
1966	34.71	41.98	14.13	6.86
1967	42.75	50.91	16.73	8.58
1968	40.88	47.05	13.34	7.18
1969	37.79	39.67	8.97	7.09
1970	43.74	45.29	7.27	5.72
1971	71.18	77.91	17.83	11.11
1972	61.49	67.77	16.54	10.25
1973	47.38	50.91	10.47	7.22
1974	59.50	71.18	22.26	10.58

Source: Data used are the same as those under tables A-6 through A-8.

Note: All excess capacities were calculated by subtracting production of crude steel in metric tons from estimates of effective capacities for the production of crude steel in metric tons. The capacity were converted from metric tons to net tons.

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Table B-10.--Adjusted price indexes for restraining countries, 1950-1974

(1963=100)

Year	Japan	Belgium	France	Germany	Italy	Luxembourg	Netherlands	United Kingdom
1950	75	-	47	66	-	-	63	62
1951	80	-	54	73	68	-	70	67
1952	82	-	61	77	70	-	72	72
1953	82	85	62	76	72	-	71	74
1954	84	85	63	77	74	-	74	75
1955	85	86	64	78	77	-	77	78
1956	88	89	67	81	80	-	80	83
1957	91	92	71	83	81	-	84	86
1958	93	94	79	86	83	-	86	89
1959	95	94	84	87	83	-	88	90
1960	96	95	87	89	85	96	90	94
1961	98	96	90	93	87	96	92	94
1962	99	97	94	97	92	96	95	98
1963	100	100	100	100	100	100	100	100
1964	102	105	104	103	106	107	103	103
1965	104	110	107	106	110	110	114	108
1966	107	115	110	110	113	114	121	113
1967	110	119	113	111	116	116	126	116
1968	114	122	118	113	118	122	130	121
1969	110	127	125	117	124	132	138	128
1970	127	133	133	125	131	151	146	137
1971	133	140	140	135	141	150	159	140
1972	139	143	149	143	149	157	173	162
1973	154	158	161	151	167	175	188	173
1974	185	177	178	162	197	203	205	199

Source: Compiled from official statistics of the Organization of Economic Cooperation and Development (OECD).

Note.--The adjusted price indexes were derived from GNP price indexes of the individual countries. The indexes were converted into U.S. dollars by using the average yearly domestic exchange rates of the individual countries. Adjusted GNP price indexes for the above countries were included in OECD, National Accounts of OECD Countries, various issues.

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Table B-11.--Adjusted price indexes for some nonrestraining countries and international organizations, 1950-74

(1963=100)

Year	Austria	Canada	Spain	EEC	OECD, European members	OECD, all members
1950	-	-	-	57	67	67
1951	-	-	-	64	63	73
1952	-	-	-	69	68	76
1953	71	82	-	70	69	77
1954	74	84	-	71	70	78
1955	77	85	-	72	72	80
1956	80	88	-	75	76	83
1957	84	91	-	78	80	86
1958	84	92	81	84	84	89
1959	86	95	85	86	87	91
1960	89	96	86	88	89	93
1961	94	97	87	91	92	95
1962	97	98	90	95	96	97
1963	100	100	100	100	100	100
1964	103	103	106	104	104	103
1965	109	106	117	108	108	106
1966	113	111	125	112	113	110
1967	117	115	132	114	118	113
1968	119	119	137	117	120	117
1969	122	124	141	123	124	123
1970	123	130	150	131	134	130
1971	135	134	162	140	144	138
1972	145	141	175	150	153	145
1973	155	154	195	161	166	156
1974	170	178	225	179	185	175

Source: Compiled from official statistics of the Organization of Economic Cooperation and Development.

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APPENDIX C

STATISTICAL ANALYSIS OF THE OMA'S IN THE COLOR TELEVISION RECEIVER INDUSTRY

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This appendix is a statistical analysis of the OMA's in the U.S. color television receiver industry. The analysis provides estimates of the effects of the OMA's on the levels of imports of color television receivers, domestic average prices, consumption, production, and employment as stated in chapter 3. It consists of three sections. Section 1 specifies a statistical model of the industry. Section 2 presents the empirical results of the model that were used to estimate the economic effects. Section 3 contains statistical tables.

Specifications of the model

The characteristics of the U.S. color television receiver industry are very different from those of the steel industry because of the lesser importance of scale economies in TV receiver production. In this situation, small firms could be as efficient as large firms. The U.S. color television receiver industry is predominantly an assembling and labor-intensive industry. 1/ The required capital expenditures for a new firm are less than those for a steel mill.

There are two large firms, Zenith and RCA, in the industry. Since the sum of their shares is less than 50 percent of the total U.S. color-set market, the market structure cannot be considered as a duopoly. 2/ It is also not proper to classify the structure as a price leadership industry because neither Zenith nor RCA appears to be able to control the price. In fact, the price competition is very keen. In addition, products of the firms in the industry are differentiated. Thus, the theoretical arguments for a partial equilibrium under a price-searchers' market as stated in appendix A may be applied to the color television receiver industry.

Besides the market structure, the following facts should be taken into consideration:

1. Television receivers are differentiated goods. In the color television receiver market, product differentiation can be described by size of screen, outward design, control devices, and facilities to accommodate additional accessories such as video, camera, and so forth. Imports of color television receivers cannot be regarded as perfect substitutes for domestic products. Only few sets with screen sizes larger than 20" are imported each year.

1/ The capital-labor ratio of the U.S. television, radio, and communication industry (sector 56, 1974 U.S. Input-output Table), was $7,973. See Tsao, op. cit. table 4.4. The capital-labor ratio of the Japanese color television receiver industry may differ from the one of the United States. Compared with production by American firms, the Japanese firms probably produce more TV parts by themselves, i.e., they are more vertically integrated than U.S. producers.

2/ Table C-1 in this appendix shows market shares of leading brands in U.S. color television market.

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A problem relating to differentiated goods is quantifying consumer taste or preference. A change in consumer taste may result in a change in demand. It is possible that the shift in consumer preference from console sets to table and portable color sets since the late 1960's could be a factor that caused the increase in import demand for this type of Japanese television receiver. It is difficult to define a variable that can explain the switch in demand from one to another particular type of television receiver. However, the problem is not serious when dealing with total demand. Since this paper studies the impact of the OMA's on the whole color television industry, only aggregate data, which are not broken down by screen sizes of major types, were used.

2. Firms in the industry generally produce monochrome television sets or other durable electronic products in addition to color television sets. 1/ In order to maximize their profits, firms may change their product mix over time. In a time-series analysis, changes in the product mix may cause difficulties in fixed-costs identification, capacity utilization, and net profits in the color television segment of the firms or the industry. This fact restricts our use of supply-side variables and emphasizes the demand-side variables.

3. Data for the domestic color television receiver industry are very limited. Many data cannot be broken down into color or monochrome sets. Prior to 1970, values of imports of color television receivers were reported at very low levels. The short history of imports prevents use of the annual data to perform time-series analyses. Thus, data for fitting this statistical model must be on a quarterly basis.

The indirect method, which was used to derive the impact of the VRA's on steel mill products, cannot be applied to television receivers due to a lack of information on foreign suppliers such as capacity utilization rates and cost data. Instead, a direct approach was employed to estimate the impact of the OMA's on color television sets.

To estimate the impact of the trade restriction on domestic consumption, a partial-equilibrium model of the commodity under restraint can be used. The supply function might be included in a partial-equilibrium model so as to resolve potential identification problems, although most empirical models ignore supply functions and contain only demand functions. 2/ An assumption which is frequently used in this connection is that foreign and domestic supplies are perfectly elastic. The simplest procedure to deal with conceptual identification problems would be to regard the supply as determined exogenously.

1/ In 1980, only three U.S.-owned firms produced monochrome receivers in domestic facilities. Many components and tubes they used were imported from Taiwan and Singapore.

2/ Theoretically, supply functions can be defined only under conditions of the price-takers' market. Besides, supply data of the industry before 1977 are not readily available.

The statistical model of the color television receiver industry includes domestic demand, domestic price, and import demand functions. No supply functions are included.

Domestic demand function.--Television receivers are consumer durable goods. Personal income or expenditure is a main factor that the consumer takes into account when he considers the purchase of a television set. Following the demand functions of classical economic theory that quantities demanded for each commodity are a function of all the prices and income or expenditure, one or more price variables are needed to evaluate the consumer's purchase decision. Since quarterly data are used, it is possible that income and price in a previous period may have an effect on demand in the current period. Use of one-period lagged independent variables seems appropriate.

As values of the dependent and independent variables are on a quarterly basis, there may be seasonal forces influencing their interrelationships. It may be preferable to add some explicit seasonal variables to the equations. It is assumed that the seasonal factors are linear and additive. The demand function is written as:

$$\ln X_t = a_{10} + a_{11}\ln Y_{t-1} + a_{12}\ln(P^D/P^G)_{t-1} + a_{13}Q_{1t} + a_{14}Q_{2t} + a_{15}Q_{3t} + u_{1t} \qquad \text{(C.1A)}$$

Where:

X = total quantity of color television receivers consumed domestically (in units).

P^D = Producer Price Index for color television receivers.

P^G = the implicit GNP deflator

Q_1, Q_2 and Q_3 are seasonal variables

u = disturbance term

ln = natural logarithm

1/ Compared with the disposable personal income, the expenditure on durable goods is more closely related to changes in purchase of durable goods. Thus, the expenditure is used as a surrogate for an income variable.

Domestic price equation.--The main factors affecting the domestic producer price of color television sets are input costs, which include labor wage, material costs, capital expenditures, and overhead expenses. The other variables which may influence the price are substitute prices and inventory levels. 1/ Most of the above-mentioned data are not readily available. Data concerning material costs, wages, new capital expenditures, and inventory are for the radio and television receiver industry which includes color, monochrome, and radio sets. Although the labor costs for the three products are similar, material costs for these products could differ substantially because intermediate inputs for radio sets and television receivers are not the same.

The effects of the OMA's on the producer price index are estimated with three binary variables. The price equation is specified in the following form:

$$\ln(P^D/P^G)_t = a_{20} + a_{21}\ln W_t + a_{22}\ln(P^D/P^G)_{t-1} + a_{23}OMA1 + a_{24}OMA2 + a_{25}OMA3 + a_{26}T + U_{2t} \qquad (C.2A)$$

Where:

W = hourly labor wage (in constant dollars).

OMA1 = binary variable for the first year of the OMA in color television receivers; covering the third quarter of 1977 through the second quarter of 1978.

OMA2 = binary variable for the second year of the OMA in color television receivers; covering the third quarter of 1978 through the second quarter of 1979.

OMA3 = binary variable for the third year of the OMA in color television receivers; covering the third quarter of 1979 through the second quarter of 1980.

(Definitions for other variables are stated under equation C.1A)

T = time trend

Total import demand function.--It is hypothesized that U.S. imports of color television receivers are a function of relative prices and the level of personal income or expenditures. Relative prices enter the equation to show the alternative costs to U.S. purchasers of buying either domestic or imported television sets. The level of personal expenditures is introduced to show the effects of changes in the expenditures on quantities demanded of imported color sets. Because the levels of imports might be affected by seasonal forces, the explicit seasonal variables included in the domestic demand equation may also enter this equation.

1/ H. Tsurumi and Y. Tsurumi used three independent variables in their price equation. They explained that the price of color television sets is a function of average unit costs, lagged stock of inventory, and lagged price of a substitute. They did not estimate coefficients of these three variables due to a lack of data. Explanations for inclusions of these three variables can be found in their paper titled "A Bayesian Test of the Product Life Cycle Hypothesis as Applied to the U.S. Demand for Color-TV Sets," International Economic Review, October 1980.

The total import demand function of color television receivers is specified as:

$$\ln M_t = a_{30} + a_{31}\ln Y_{t-1} + a_{32}\ln(P^M/P^D)_{t-1} + a_{33}Q_{1t} + a_{34}Q_{2t} + a_{35}Q_{3t} + u_{3t} \qquad (C.3A)$$

Where:

M = total imports of color television receivers (in units)

P^M = unit value of imported color television receivers (dollars per set)

Q_1, Q_2, Q_3 = binary seasonal variables

Import demand function for Japanese color television receivers.--The domestic expenditure and the relative price are the two continuous variables in this equation. The relative price variable is defined as the ratio of the Japanese export price index for color television receivers to the U.S. Producer Price Index for color television sets.

The seasonal variables are also included in this equation to adjust seasonal variations. Since Japan was the major foreign supplier to the U.S. color television receiver market prior to the OMA period, the import demand function of Japanese color television sets is specified in a similar form to the total import demand function:

$$\ln M^J_t = a_{40} + a_{41}\ln Y_{t-1} + a_{42}\ln(P^J/P^D)_{t-1} + a_{43}Q_{1t} + a_{44}Q_{2t} + a_{45}Q_{3t} + u_{4t} \qquad (C.4A)$$

Where:

M^J = imports of color television receivers (in units)

P^J = Japanese export price index of color television receivers

Import demand function for Korean color television receivers.--Compared with Japan and Taiwan, Korea has the shortest history of exportation of color television receivers. Since there was no color television broadcasting in Korea during the 1970's, production was solely for export. Volumes of Korean exports have fluctuated widely during the past 7 years. Presumably, the factors affecting U.S. imports of Korean television sets are the same as those for Japanese television receivers. The relative price variable is defined as the ratio of the unit value index for Korean color television receivers to the

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U.S. Producer Price Index for color television receivers. 1/ The import function for Korean television sets is written as:

$$\ln M_t^k = a_{50} + a_{51}\ln Y_{t-1} + a_{52}\ln(P^K/P^D)_{t-1} + a_{53}Q_{1t} + a_{54}Q_{2t} + a_{55}Q_{3t} + u_{5t} \qquad (C.5A)$$

Where:

M^k = imports of Korean color television receivers (in units)

P^K = import unit value for Korean color television receivers (dollars per set)

Import demand function for Taiwan color television receivers.--Several U.S. television manufacturers such as RCA, Zenith, and Admiral have established their assembly plants in Taiwan since the mid-1960's. 2/ Present volumes of U.S. imports include Taiwan-made and assembled television sets. Levels of imports from Taiwan seem more stable than those from Korea. Trade statistics show that the average unit value for Taiwan color television sets was about the same as the one for Korean sets. The import function is formed as:

$$\ln M_t^T = a_{60} + a_{61}\ln Y_{t-1} + a_{62}\ln (P^T/P^D)_{t-1} + a_{63}Q_{1t} + a_{64}Q_{2t} + a_{65}Q_{3t} + u_{6t} \qquad (C.6A)$$

Where:

M^T = imports of Taiwan color television receivers (in units)

P^T = import unit value for Taiwan color television receivers (dollars per set)

The specification of the above equations has considered both data and mathematical constraints. For instance, the use of log-linear form requires a positive value for all variables. This restriction prohibits the introduction of any variables with negative values. 3/

1/ The weighted average export prices of Korean television receivers are not readily available.

2/ Admiral is no longer a producer.

3/ In their linear demand equation for television receivers, H. S. Houthakker and L. D. Taylor used a price-difference variable (first difference i.e. $\Delta P_t = P_t - P_{t-1}$) in addition to the lagged price variable (P_{t-1}) and the expenditure variable. Since more recent changes in nominal prices of television receivers may have negative values, a linear logarithmic demand function cannot include a price difference variable. In fact, the real price of color television receivers has continuously declined during the past decade. For details, see H. S. Houthakker and L. D. Taylor, Consumer Demand in the United States, 1929-70, Harvard University Press, 1966.

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Empirical results

Unless otherwise stated all estimated equations have been fitted to quarterly data for the period 1974-80. The fitting procedure adopted is that of ordinary least squares regression (OLS). The Cochrane-Orcutt iterative technique (COI) was used for the estimated equations below, which have a low Durbin-Watson statistic. All data used were published information.

Domestic demand function.--The estimation resulted in the following domestic demand functions:

$$\ln X_t = \underset{}{12.5365} + \underset{(4.7340)}{1.0102}\ln Y_{t-1} - \underset{(-0.8324)}{0.3070}\ln (P^D/P^G)_{t-1} - \underset{(-8.0561)}{0.0245}\,Q_{1t}$$

$$- \underset{(-8.3245)}{0.0276}\,Q_{2t} - \underset{(-4.3290)}{0.0129}\,Q_{3t} \qquad \text{(C.1B)}$$

$R^2 = 0.9335$ D.W. = 1.8075 F(5,17) = 47.7494 OLS/COI

D.W. is the Durbin-Watson statistic. 1/ One measure of goodness of the fit is shown by the coefficient of determination (R^2). The numbers in parentheses are t ratios.

All estimated coefficients have the expected signs. Except for the relative price term, every estimated coefficient is statistically significant at the 0.01 level or better. The derived relative price elasticity is 0.307, and the expenditure elasticity is 1.01. These results are consistent with those found by Stone and Rowe. In their equation for durable household goods, the relative price coefficient was inelastic and insignificant. Their two expenditure coefficients, the current and the lagged, are statistically significant. 2/ All three seasonal coefficients of this equation are significant, implying that there are seasonal variations in the consumption of color television sets.

Domestic price equation.--The estimated coefficients of the independent variables which explain changes in the average producer price are represented in the following equation:

$$\ln(P^D/P^G)_t = \underset{(54.9147)}{5.5535} + \underset{(9.8113)}{0.2019}\ln(P^D/P^G)_{t-1} - \underset{(-9.2144)}{0.0206T} + \underset{(0.1519)}{(10^{-2})0.261000MA1}$$

$$+ \underset{(1.1531)}{(10^{-1})\,0.219200MA2} + \underset{(1.2118)}{(10^{-1})0.243000MA3} \qquad \text{(C.2B)}$$

$R^2 = 0.9755$ D.W. = 1.6953 F(5,21) = 166.9700 OLS/COI

1/ The original estimation generated a value of D.W. of 0.7652. It is likely that the disturbances were autocorrelated. Thus, the Cochrane-Orcutt iterative technique was used.

2/ J. R. N. Stone and D. A. Rowe, "Dynamic Demand Functions: Some Econometric Results," Economic Journal, 68 (1958) pp. 256-270.

The lagged price coefficient has the expected positive sign. The negative sign of the trend coefficient indicates that the producer price of color television sets has declined. The real wage variable was dropped due to the unreasonable and statistically insignificant negative sign. 1/ The magnitudes of the three OMA variables imply that the OMA had a cumulative effect on the producer price. The OMA caused a 0.3-percent increase in the price in the first year and a 2.4-percent increase in the third year. The sizes of the effect could be larger if the price variable were defined in terms of the current price.

Total import demand function.--The total import demand function was estimated by OLS and the Cochrane-Orcutt procedure and produced the following results: 1/

$$\ln M_t = \underset{(-0.6908)}{-7.8349} + \underset{(3.1054)}{5.0940} \ln Y_{t-1} - \underset{(0.2981)}{0.6012} \ln (P^M/P^D)_{t-1}$$

$$- \underset{(-1.1348)}{0.0237} Q_{1t} + \underset{(-0.016)}{0.0035} Q_{2t} + \underset{(0.8243)}{0.0879} Q_{3t} \qquad \text{(C.3B)}$$

$R^2 = 0.8612$ D.W. = 1.5789 F(5,7) = 9.7490 OLS/COI 2/

Both the expenditure and the relative price coefficients have the expected signs. The expenditure coefficient has a significant t-ratio. The expenditure elasticity is larger than the price elasticity. The expenditure variable is more important in explaining variations in import demand. The values of the seasonal coefficients show the existence of small seasonal variations in the imports for all four quarters.

1/ The following estimated equation includes the wage variable:

$$\ln(P^D/P^G)_t = \underset{(1.11459)}{13.9461} - \underset{(-0.7997)}{8.4748} \ln W_t + \underset{(2.7704)}{0.2926} \ln(P^D/P^G)_{t-1} - \underset{(-0.9690)}{0.0572T}$$

$$+ \underset{(2.1145)}{0.84230MA1} + \underset{(2.7152)}{1.29490MA2} + \underset{(0.6697)}{0.30460MA3}$$

$R^2 = 0.7631$ D.W. = 1.6073 F(5,21) = 9.8982

The inclusion of the wage variable produced a negative coefficient estimate for the wage variable. On a priori grounds, the result is not acceptable, and thus the wage variable was deleted. Because of the strong trend in wages, the effect of wages on relative prices was picked up by the trend variable in C.2B and cannot be netted out.

2/ This equation was estimated with a sample that has only 14 observations, covering the first quarter of 1974 through the second quarter of 1977.

Import demand functions for restraining countries.--Based on the forms specified in equations C.4A through C.6A, the import functions of the three restraining countries were estimated, producing the following results:

$$\ln M_t^J = -2.8402 + \underset{(0.1329)}{5.5056} \ln Y_{t-1} - \underset{(2.2050)}{2.1247} \ln (P^J/P^D)_{t-1} - \underset{(0.7101)}{0.1139} Q_{1t} + \underset{(-1.2367)}{0.0711} Q_{2t} + \underset{(0.4889)}{0.0923} Q_{3t} \quad (C.4B)$$

$$(1.0606)$$

$R^2 = 0.8790$ D.W. = 1.6393 F(5,6) = 8.9172

$$\ln M_t^K = -2.9070 + \underset{(-0.6787)}{5.6228} \ln Y_{t-1} - \underset{(6.0284)}{2.6573} \ln (P^K/P^D)_{t-1} - \underset{(4.5913)}{0.0446} Q_{1t} - \underset{(1.8435)}{0.1107} Q_{2t} - \underset{(4.4769)}{0.0425} Q_{3t} \quad (C.5B)$$

$$(-1.7699)$$

$R^2 = 0.8946$ D.W. = 2.1106 F(5,7) = 11.8825 OLS/COI

$$\ln M_t^T = 3.3862 + \underset{(0.2982)}{3.2510} \ln Y_{t-1} - \underset{(1.3374)}{2.0254} \ln (P^T/P^D)_{t-1} - \underset{(-0.9065)}{0.0420} Q_{1t} - \underset{(-1.1947)}{0.0147} Q_{2t} - \underset{(0.4030)}{0.0235} Q_{3t} \quad (C.6B)$$

$$(0.0644)$$

$R^2 = 0.4293$ D.W. = 2.4308 F(5,8) = 1.7210 1/

The import equation for Japanese color television receivers, C.4B, shows an elastic price coefficient. Expenditure is the only statistically significant variable in determining volumes of imported Japanese color television receivers.

The import equation for Korean color television receivers, C.5B, includes elastic price and elastic expenditure coefficients. Both coefficients are statistically significant. However, the expenditure variable is more powerful in explaining the variations in the volume of imported Korean color television receivers.

The import equation for Taiwan color television receivers has elastic expenditure and price coefficients. The t-ratios of these two coefficients are below significant ranges. The signs of the three seasonal coefficients suggest that the imports from Taiwan were relatively large in the fourth quarters of the years included in the sample period.

1/ With (5, 8) degrees of freedom, the critical value for 1% level of significance is 6.63. The regression is not significant. Equation C.6B was not used for the purpose of estimating.

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The above empirical results reveal that the expenditure level is a main determinant for U.S. consumption of color television receivers. The price is also an important factor affecting the domestic consumption. However, the t-ratios of the expenditure coefficients in the four import equations are larger than those of price coefficients. This indicates that the expenditure elasticity is more reliable than the price elasticity for evaluating OMA's effects.

Statistical Tables on Color Television Receivers

The data used for fitting the model are included in the following tables.

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Table C-1.--Color television receivers: Market shares of leading brands in the U.S. market, by model years, 1974-79

(In percent)

Brand	Model Years:--					
	1979	1978	1977	1976	1975	1974
RCA	21.0	20.0	20.0	20.0	19.0	20.5
Zenith	20.5	21.15	22.0	23.0	24.0	23.75
Magnavox	7.2	7.0	7.0	6.5	6.6	6.75
Sears	7.9	8.55	9.0	9.0	8.7	7.5
Quasar 1/ (Matsushita)	5.0	5.3	5.0	5.0	5.9	6.75
GE	6.9	6.5	6.0	5.5	6.2	6.0
Sylvania	3.9	3.5	4.0	4.5	4.4	5.0
Admiral	1.5	2.4	2.5	3.5	3.0	3.5
Philco	1.2	1.45	1.5	1.5	1.0	-
Sony 1/	6.5	6.9	7.5	7.0	5.8	5.0
Panasonic 1/	2.2	2.9	3.0	2.3	-	-
Montgomery Ward	2.1	2.0	2.0	-	-	-
Sanyo 1/	2.0	2.0	-	-	-	-
Hitachi 1/	1.85	1.65	-	-	-	-
Sharp 1/	1.5	2.0	2.0	-	-	-
Penncrest (Penney)	1.5	1.5	-	-	-	-
Toshiba 1/	1.0	1.0	-	-	-	-
Curtis Mathes	1.0	-	-	-	-	-
MGA (Mitsubishi) 1/	1.0	1.0	-	-	-	-

1/ Indicates Far Eastern manufacturer.

Source: Television Digest and U.S. Department of Commerce, The U.S. Consumer Electronics Industry and Foreign Competition, May 1980.

Note: 1. Years indicate model rather than calendar years.

2. Market shares by brand name fail to identify production share accurately when manufacturers produce under an "OEM" label as well as their own.

3. The market shares are Television Digest's estimates based upon interviews with manufacturers and Delphi-method estimation.

Table C-2.--Color television receivers: U.S. consumption, by months, January 1972-June 1981

(In units)

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
1972-----	594,308	576,209	662,265	419,871	427,344	654,610	569,304	682,689	1,037,288	866,384	835,110	1,050,461	8,377,043
1973-----	627,766	655,879	846,298	541,858	518,991	761,665	622,483	690,443	1,131,104	909,821	905,513	1,051,682	9,263,503
1974-----	550,309	597,322	833,342	488,133	497,126	784,644	586,780	579,489	885,861	663,739	628,382	734,427	7,829,554
1975-----	401,029	407,332	549,905	420,511	441,800	617,937	441,540	507,707	745,119	646,981	623,252	682,184	6,485,297
1976-----	496,314	522,378	592,876	418,133	473,932	690,027	527,841	571,771	861,063	809,255	827,546	909,057	7,700,193
1977-----	605,244	630,796	770,977	577,142	489,378	794,760	583,109	652,575	1,104,941	936,142	934,004	1,027,758	9,106,826
1978-----	618,963	702,513	966,326	698,256	673,632	918,622	668,170	777,639	1,208,170	913,348	990,331	1,100,349	10,236,319
1979-----	622,111	711,411	1,026,648	620,781	651,462	995,931	686,629	686,316	1,055,185	882,756	868,826	1,018,429	9,846,487
1980-----	636,316	726,326	934,414	514,251	538,969	925,187	648,097	783,876	1,198,867	955,909	1,077,998	1,217,136	10,162,270
1981-----	885,268	807,214	992,320	703,620	747,609	1,007,584	-	-	-	-	-	-	-

Source: Electronic Industries Association.

Note.--Values are the same as those of domestic sales to dealer prepared by EIA Marketing Services Department.

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Table C-3.--U.S. real expenditures on durable goods, Producer Price Index for color television sets, implicit GNP deflator, and hourly wages, by quarters, January 1974-December 1979

Period	U.S. real expenditure on durable goods	Producer Price Index for color television sets	Implicit GNP deflator	Hourly wage
	(billions of 1972 dollars)	(1972 = 100)	(1972 = 100)	
1974				
January-March	26.29	108.46	111.56	$3.65
April-June	27.48	109.80	114.54	3.75
July-September	28.88	110.67	118.03	3.92
October-December	25.78	111.35	121.60	4.05
1975				
January-March	26.50	112.00	124.55	4.13
April-June	27.10	110.70	125.93	4.20
July-September	28.78	113.99	128.07	4.34
October-December	29.50	113.39	130.27	4.45
1976				
January-March	30.07	114.37	131.29	4.52
April-June	31.30	112.78	132.96	4.52
July-September	31.55	112.52	134.40	4.64
October-December	31.75	112.65	136.44	4.71
1977				
January-March	33.95	108.20	138.34	4.71
April-June	34.15	106.56	140.93	4.83
July-September	34.55	108.76	142.59	4.91
October-December	35.60	114.71	144.82	5.21
1978				
January-March	34.83	106.44	144.93	5.34
April-June	36.88	103.12	148.63	5.41
July-September	38.03	108.02	151.42	5.53
October-December	37.55	109.07	154.99	5.68
1979				
January-March	37.55	107.99	158.16	5.89
April-June	36.20	108.85	161.17	5.99
July-September	36.73	110.27	164.23	6.03
October-December	36.50	108.89	167.47	6.20

Source: Compiled from official statistics of the U.S. Bureau of Labor Statistics and Economic Report of the President, 1981.

Note.--Hourly wage was based on the average hourly earning of production workers in the Radio and TV Equipment Industry (1972 SIC Code 3662).

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Table C-4.--Color television receivers: U.S. imports by principal sources and by quarters, January 1974-December 1980

Period	U.S. imports from Japan	Total imports as percent of domestic consumption	U.S. imports from Korea	U.S. imports from Taiwan	Total U.S. imports
	1,000 units		1,000 units	1,000 units	1,000 units
1974					
January-March	135.1	11.7	0.0	76.2	231.4
April-June	284.4	22.1	6.2	97.9	391.5
July-September	264.6	18.2	7.8	50.7	373.9
October-December	234.2	13.7	8.5	112.3	285.4
1975					
January-March	113.0	11.7	2.1	39.8	157.3
April-June	198.8	16.6	8.4	35.5	245.4
July-September	327.8	21.5	2.7	32.9	364.2
October-December	404.3	23.0	8.8	35.3	448.7
1976					
January-March	382.8	26.4	10.0	33.2	426.1
April-June	547.1	36.9	6.0	30.8	584.2
July-September	856.5	52.0	11.0	95.1	1,020.4
October-December	895.5	49.7	21.0	79.2	1,264.5
1977					
January-March	562.6	40.8	22.5	48.2	819.1
April-June	627.3	62.1	10.7	99.1	1,155.9
July-September	557.0	29.5	20.8	81.6	689.6
October-December	388.8	20.1	44.4	96.8	579.1
1978					
January-March	344.2	24.9	49.1	115.4	569.5
April-June	385.0	29.6	67.6	164.6	677.0
July-September	435.3	30.4	119.8	179.8	807.4
October-December	339.1	26.2	200.4	167.5	787.6
1979					
January-March	189.2	18.8	147.3	77.3	444.5
April-June	128.2	15.6	91.0	91.6	354.6
July-September	144.2	14.3	10.9	109.9	347.3
October-December	168.4	13.1	64.9	91.3	364.4
1980					
January-March	60.2	9.3	36.1	73.8	213.7
April-June	108.0	15.8	77.1	82.4	311.9
July-September	127.5	11.9	86.3	75.3	313.8
October-December	157.7	13.0	94.1	72.9	422.2

Source: Compiled from official statistics of the U.S. Department of Commerce (Series IM-146) by The Commission Statistical Service Division.

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Table C-5.--Color television receivers: Unit values of U.S. imports, by quarters, January 1974-December 1980

(Per unit)

Period	Unit value of total U.S. imports	Unit value of U.S. imports from Japan	Unit value of U.S. imports from Korea	Unit value of U.S. imports from Taiwan
1974				
January-March	$188.49	$231.31	$170.00	$155.83
April-June	192.81	206.61	169.93	151.15
July-September	186.66	200.02	187.49	128.09
October-December	187.60	180.58	190.32	135.36
1975				
January-March	177.55	192.54	93.43	139.24
April-June	185.38	190.61	185.31	151.25
July-September	181.94	182.39	185.88	172.64
October-December	180.64	223.79	154.81	173.42
1976				
January-March	176.25	177.01	157.33	171.02
April-June	186.03	187.09	154.15	170.99
July-September	191.53	181.68	148.28	161.39
October-December	156.47	178.58	146.52	159.52
1977				
January-March	163.97	192.56	133.92	153.89
April-June	141.53	186.84	148.82	178.48
July-September	201.54	203.64	152.26	180.82
October-December	203.68	233.03	156.49	178.08
1978				
January-March	204.18	215.57	149.65	184.36
April-June	218.83	220.87	156.68	187.68
July-September	200.20	218.28	167.48	184.42
October-December	204.78	221.19	167.94	185.79
1979				
January-March	194.56	191.57	167.43	186.48
April-June	228.18	324.22	163.92	190.92
July-September	280.92	261.71	169.84	193.40
October-December	275.60	227.64	179.26	192.69
1980				
January-March	244.05	293.81	189.15	193.25
April-June	231.41	246.44	187.36	197.30
July-September	235.88	252.31	189.08	193.00
October-December	248.05	304.94	183.11	191.42

Source: Compiled from official statistics of the U.S. Department of Commerce by The Commission Statistical Service Division.

APPENDIX D

STATISTICAL ANALYSIS OF THE OMA'S IN THE NONRUBBER FOOTWEAR INDUSTRY

This appendix is a statistical analysis of the OMA's in the U.S. nonrubber footwear industry. The analysis provides the estimates of the effects of the OMA's on the levels of imports of nonrubber footwear, domestic price, consumption, production, and employment as stated in chapter 4. The appendix consists of three sections: (1) specification of a statistical model of the nonrubber footwear industry; (2) empirical results of the model that were used to estimate the economic effects; and (3) statistical tables. When practicable, the estimates and the empirical results will be compared with those of the other empirical studies on the footwear industry. 1/

Specifications of the model

The market structure of the U.S. footwear industry can be classified as price-searchers' market characterized by the presence of a large number of firms, product differentiation, and absence of dominant firm(s). Each firm has a relatively small share of the total market, so each has a very limited amount of control over market price; footwear is significantly differentiated as to fashion, quality, and material used. The largest 20 firms in the industry have a market share of less than 50 percent. Competition in a price-searchers' market under these conditions can be also classified as monopolistic competition in economic literature. This literature provides the theoretical foundation for the model employed here. 2/

The statistical model to be discussed comprises five equations that will be used to assess the impact of the OMA's on the U.S. nonrubber footwear industry. In specifying these equations, the traditional assumptions are made about the behavior of firms in a monopolistically competitive industry, such as profit maximization, product differentiation, and limited price control. Because shoes are differentiated products, it is appropriate to assume that imported shoes are imperfect substitutes for domestically produced shoes, and domestically produced shoes are imperfect substitutes for each other.

Total demand function.--Shoes are consumer durable goods and are bought when needed. One of the main factors that a consumer takes into account when he considers the purchase of shoes is his disposable income. Other factors affecting demand include prices of nonrubber shoes and substitutes for

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1/ The following are three recent studies which contain parameter estimates for the footwear industry: M. D. Bale, Output and Employment Changes in a Trade Sensitive Sector: Adjustment in the U.S. Footwear Industry. World Bank Staff Working Paper No. 340, Washington, D.C., October 1980. A. Sykes, The Impact of Import Competition on Domestic Industries: Theory and Empirical Applications, an unpublished paper of the USITC, August 1979. M. Szenberg, J.W. Lombardi, and E. Y. Lee, Welfare Effects of Trade Restrictions, New York, 1977.

2/ Monopolistic competition entails a large number of sellers acting independently, and selling differentiated goods. Monopolistically competitive producers have a limited amount of control over product price. For details, see E. H. Chamberlin, The Theory of Monopolistic Competition, 3rd Ed. Cambridge, 1970.

nonrubber shoes. 1/ Most consumers possess more than one pair of shoes. When the price is high, some delay purchases, and some buy extra pairs when shoes are on sale.

All demand and income variables in this model are defined on an aggregate basis. An approximation of constant price and income elasticities is imposed. The estimated total demand function is in the following form:

$$\ln D_t = a_{10} + a_{11}\ln Y_t + a_{12}\ln(P^D/P^G)_t + u_{1t} \qquad (D.1A)$$

where:

D = total consumption of nonrubber footwear: domestic production + imports - exports (in millions of pairs).

Y = real disposable personal income index.

P^D = producer price index for nonrubber shoes.

P^G = general producer price index.

u = disturbance term.

ln = natural logarithm.

Domestic price equation.--Factors affecting the cost of producing footwear are input costs, fixed costs, and levels of output. The U.S. footwear industry is more labor intensive than the television receiver industry. 2/ Therefore, an increase in labor costs tends to push up the production costs more than in the television receiver industry.

In order to test the hypothesis that the OMA has a positive effect on the domestic producer prices, three binary variables were used along with the cost variables. Each of the variables represents a year in which the OMA's were in effect. Thus, the domestic price equation is written as:

$$\ln(P^D/P^G)_t = a_{20} + a_{21}\ln W_t + a_{22}\ln Q_t + a_{23}\text{OMA1} + a_{24}\text{OMA2} + a_{25}\text{OMA3} + u_{2t} \qquad (D.2A)$$

where:

W = real wage, the hourly wage deflated by general producer price index (1967=100).

Q = domestic production (in millions of pairs).

1/ The substitutability between rubber and nonrubber footwear is low. Many types of rubber footwear such as waterproof overshoes and rubber boots are not perfect or close substitutes for nonrubber footwear. Sneakers may be close substitutes for nonrubber shoes in certain income and age groups, however.

2/ According to U.S. technical coefficients based on the 1974 U.S. input-output table, the capital-labor ratio of the footwear and other leather products industry was $4,988.89; the ratio for the television, radio and communication equipment industry was $7,973.54. See Tsao, op. cit. table 4.4.

OMA1 = a binary variable for the first year in which the OMA's were in effect.

OMA2 = a binary variable for the second year in which the OMA's were in effect.

OMA3 = a binary variable for the third year in which the OMA's were in effect.

Total import demand equations.--The two traditional explanatory variables for import demand--domestic income and price--are included in this equation. The price term is defined as a relative price (the ratio of the import price to the domestic price). 1/ Dispcsable personal income is used as the income variable.

The total import demand function is specified as:

$$\ln M_t = a_{30} + a_{31}\ln Y_t + a_{32}\ln(P^M/P^D)_t + u_{3t} \qquad (D.3A)$$

Where:

M = imports of nonrubber footwear (in millions of pairs).

P^M = import unit value for nonrubber footwear (dollars per pair).

Import function for restraining countries.--The demand for exports from one country is the demand of the rest of the world, not just the U.S. demand for imports from that country. A supply function for exports to the United States can not be assumed to exist, independent of import demand from the rest of the world, except under perfect competition. 2/ Usually, export supply or export price equations are expressions of quantities or prices as a function of input costs and economic activity of the exporting industry, and some other variables. Since there is a lack of information about Korean and Taiwan exporting industries, the supply functions for exports to the United States or export price equations cannot be estimated.

The income variable included in equation D.3A is also used here to explain variations in imports of nonrubber footwear from the restraining countries. Prices of shoes from Taiwan or Korea are also used to explain imports from each of those countries. The final explanatory variable used was a time trend. Cross-price elasticities were not estimated, nor were binary restraint-period variables included in the regression equation, because of the few observations available for each country.

1/ Alternatively, the price term can be decomposed into two terms: domestic price and import price.

2/ G. Basevi, "Commodity Trade Equations in Project Link," in The International Linkage of National Economic Models, edited by R. J. Ball, Amsterdam, 1973, pp. 238-240.

$$\ln M_t^K = a_{40} + a_{41}\ln Y_t + a_{42}\ln(P^K/P^D)_t + a_{43}T_t + u_{4t} \qquad (D.4A)$$

$$\ln M_t^T = a_{50} + a_{51}\ln Y_t + a_{52}\ln(P^T/P^D)_t + a_{53}T + u_{5t} \qquad (D.5A)$$

where

M^K = imports of nonrubber footwear from Korea (in millions of pairs).

P^K = unit value for nonrubber footwear imported from Korea (in dollars)

M^T = imports of nonrubber footwear from Taiwan (in millions of pairs).

P^T = unit value for nonrubber footwear imported from Taiwan (in dollars)

Empirical results and explanations

Equations D.1A (total demand) and D.2A (domestic price) have been fitted to annual data for the period 1958-79. The numbers of observations for equations D.3A (total import), D.4A (Korea), and D.5A (Taiwan) are 19, 10, and 13, respectively. The estimating procedure adopted is that of ordinary least squares regression (OLS). The Cochrane-Orcutt iterative technique (COI) was used for certain estimated equations that had a low original value of the Durbin-Watson statistic. All data used are published information.

Total demand function.--The estimated coefficients of explanatory variables included in the total demand function are as follows:

$$\ln D_t = 5.5523 + 0.3188\ln Y_t - 0.1205\ln(P^D/P_t^G) \qquad (D.1B)$$
$$(10.4501)\quad (2.5393)\quad (-5.3472)$$

$R^2 = 0.9480$ D.W. = 1.8523 F(2,18) = 164.1940 OLS/COI 1/

The value of the Durbin-Watson statistic (1.8523) suggests that no serial autocorrelation exists among the error terms in the first order. An indicator of the goodness of the fit (R^2) is the coefficient of determination (0.9423). The numbers in parentheses are the values of the t ratios, which indicate that all coefficients are significant at the 0.01 level or better. The coefficients of two explanatory variables have the expected signs.

The price coefficient indicates that demand is inelastic. The result is consistent with the results of Szenberg, Bale, Houthakker and Taylor. 2/ In interpreting their low price elasticity of demand for shoes (-0.09), Houthakker and Taylor argued that price is much less important than personal consumption expenditure in explaining U.S. consumption of shoes. They stated that the lack of a strong overall influence of prices is consistent with the predominance of habit formation. 3/ The estimated coefficient of the income variable shows that a 10-percent increase in disposable personal income would result in only a 3.2 percent increase in quantity demanded.

1/ The two-stage method was first used to estimate this equation. The estimated P^D/P^G from equation D.2B was highly correlated with Y, and resulted in a positive price coefficient with an insignificant t ratio. Thus, we estimated the equation with OLS/COI.

2/ The price elasticities of demand estimated by Szenberg and Bale are -0.47 and -0.70, respectively.

3/ Houthakker and Taylor, op. cit., p. 152.

Domestic price equation.--The domestic price equation was estimated and resulted in the following estimated coefficients:

$$\ln(P^D/P^G)_t = \underset{(13.0076)}{2.8826} + \underset{(10.1306)}{0.5434}\ln W_t + \underset{(5.9811)}{0.2090}\ln Q_t + \underset{(0.2015)}{(10^{-2})0.3687}OMA1 +$$

$$+ \underset{(0.5044)}{(10^{-2})0.9919}OMA2 + \underset{(4.3765)}{(10^{-1})0.9296}OMA3 \qquad (D.2B)$$

$R^2 = 0.9584$ D.W. = 1.5632 F(5,15) = 63.335 CLS/COI

The positive value of the output coefficient implies that a 10-percent increase in output would cause a 2-percent increase in the level of the average producer price ceteris paribus. The OMA1 coefficient shows that trade restrictions raised the average producer price by only 0.4 percent in the first OMA year. The OMA's raised prices by 1.0 and 9.3 percent in the second year and the third year, respectively. The third year was the only one with a statistically significant price effect of the OMA's.

In general, coefficients have the expected signs. Except for the two OMA coefficients, all coefficients are statistically significant at the 0.0005 level or better.

The value of the wage coefficient, 0.5434, explains the extent to which footwear is a labor-intensive good. All else being equal, a 10-percent increase in the labor cost will push up the price by 5.4 percent.

Total import demand function.--Estimates of coefficients in the total import demand function were as follows:

$$\ln M_t = \underset{(1.1174)}{12.7905} + \underset{(1.8694)}{2.3481}\ln Y_t - \underset{(-4.1819)}{4.0721}\ln(P^M/P^D)_t \qquad (D.3A)$$

$R^2 = 0.5651$ D.W. = 1.4463 F(2,16) = 9.7442

Unlike the demand equation (D.1B), this equation has both elastic income and elastic price coefficients. These results are consistent with those of Szenberg. However, Szenberg's own price elasticity is -1.4, which is smaller (in absolute terms) than the one of this study (-4.0721). 1/ The import price elasticity of this study is close to the estimate of Buckler and Almon (-4.0). 2/ The import price elasticity plays an important role in cost/benefit analyses of trade restrictions.

1/ Szenberg, op. cit., p. 69.
2/ Buckler and Almon, op. cit., p. 180.

Import function for restraining countries.--The import equations for the two restraining countries were estimated, producing the following results:

$$\ln M^K = -58.1447 + 9.20821\ln Y_t - 1.04181\ln(P^K/P^D)_t \qquad (D.4B)$$
$$(-1.7376)\quad (1.6882)\quad (-1.6317)$$

$$+ 0.290714T \qquad (D.4B)$$
$$(1.6038)$$

$$R^2 = 0.9757 \qquad D.W. = 1.7044 \qquad F(3, \ ) = 38.9732$$

$$\ln M^T = -23.0043 + 5.60781\ln Y_t - 0.73731\ln(P^T/P^D)_t \qquad (D.5B)$$
$$(2.7655)\quad (-1.7595)$$

$$+ 0.1125T$$
$$(1.4271)$$

$$R^2 = 0.9796 \qquad D.W. = 1.2803 \qquad F(3,8\ ) = 104.0020 \qquad OLS/COI$$

All estimated coefficients in the two equations have the expected signs. In equation B.4B (Korea), the relative price elasticity is -1.04. 1/ The t ratios of the two coefficients are marginally significant. The value of the income coefficient suggests that in explaining variations in imports of Korean shoes, disposable personal income may be more important than the relative price. The time trend was positively sloped during the sample period.

The coefficients in equation D.5B indicate that the volume of imports from Taiwan was sensitive to the changes in U.S. disposable personal income and insensitive to the changes in the relative price. The time trend has a positive slope.

The empirical results of the model indicate that even though total U.S. demand for nonrubber footwear is very insensitive to price changes, total import demand for nonrubber footwear exhibits a very high price elasticity. Furthermore, this model suggests that income variables in the equations for the restraining countries were more important than price variables in explaining variations in U.S. import demand for shoes from the restraining countries.

Statistical Tables

All sample data used to estimate the coefficients of the model are included in the following tables.

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Table D-1.--U.S. real disposable personal income, domestic consumption of nonrubber footwear, Producer Price Index for nonrubber footwear, and general Producer Price Index, 1958-79

Year	U.S. real disposable income index	Domestic consumption	Real Producer Price Index for nonrubber footwear	General Producer Price Index
	(1958=100)	Million pairs	(1967=100)	(1967=100)
1958	100.00	606.5	85.10	94.6
1959	104.95	656.1	90.10	94.8
1960	107.19	623.4	92.30	94.9
1961	110.47	626.6	93.10	94.5
1962	115.50	693.3	93.80	94.8
1963	119.85	664.3	93.86	94.5
1964	128.09	685.4	93.88	94.7
1965	136.02	711.3	93.89	96.6
1966	143.04	735.1	96.99	99.8
1967	148.40	726.9	100.00	100.0
1968	154.06	815.3	102.22	102.5
1969	156.93	776.7	102.91	106.4
1970	161.55	801.8	102.36	110.4
1971	167.15	802.3	102.55	113.9
1972	173.96	821.1	104.53	119.1
1973	184.42	793.9	96.88	134.7
1974	180.88	715.4	87.44	160.1
1975	181.42	694.9	84.55	174.8
1976	187.97	786.5	86.83	183.0
1977	194.68	780.8	86.87	194.2
1978	203.32	785.5	87.43	209.3
1979	209.53	793.8	92.57	235.5

Source: The U.S. Bureau of Labor Statistics, and the U.S. Department of Commerce.

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Table D-2.--Nonrubber footwear: U.S. domestic production, hourly wages, Producer Price Index for leather, and rate of capacity utilization, 1958-79

Year	Domestic production	Hourly wage in U.S. nonrubber footwear industry	Producer price index for leather	Rate of capacity utilization
	Million pairs		(1967=100)	Percent
1958	587.1	$1.51	85.3	77.4
1959	637.4	1.55	103.4	77.1
1960	600.0	1.59	93.8	76.9
1961	592.9	1.63	96.1	75.4
1962	633.2	1.68	98.4	78.8
1963	604.3	1.71	92.4	75.7
1964	612.8	1.77	93.3	77.7
1965	626.2	1.82	98.0	81.9
1966	641.7	1.87	109.8	80.2
1967	600.0	2.01	100.0	78.4
1968	642.4	2.18	102.1	82.7
1969	577.0	2.31	106.7	77.8
1970	562.3	2.43	107.7	76.1
1971	535.8	2.53	109.6	77.0
1972	526.7	2.62	142.9	78.2
1973	490.0	2.72	160.6	75.0
1974	453.0	2.91	149.5	73.1
1975	413.1	3.08	147.8	69.1
1976	422.5	3.28	186.7	75.9
1977	418.1	3.48	194.8	76.0
1978	418.9	3.75	230.8	75.2
1979	397.5	4.09	359.4	76.6

Source: The U.S. Bureau of Labor Statistics, and American Footwear Industries Association, Footwear Mannual, 1981.

Note.--Hourly labor wage was based on the average hourly earnings of production workers in the footwear, except rubber, industry (1972 SIC Code 314).

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Table D-3.--Nonrubber footwear: Total U.S. imports, U.S. imports from Korea and Taiwan, and ratio of imports to domestic consumption, 1958-79

Year	Total U.S. imports	Ratio of imports to domestic consumption	U.S. imports from Taiwan	U.S. imports from Korea
	Million pairs		Million pairs	Million pairs
1958	23.6	3.9	0	0
1959	22.3	3.4	0	0
1960	26.6	4.3	0	0
1961	36.7	5.9	0	0
1962	63.0	9.1	0	0
1963	62.8	9.5	0	0
1964	75.4	11.0	1.5	0
1965	87.6	12.3	6.0	0
1966	96.1	13.1	2.9	0
1967	129.1	17.8	6.7	1.5
1968	175.3	21.5	15.3	1.2
1969	202.0	22.6	25.9	1.3
1970	241.6	30.1	42.0	1.9
1971	268.6	33.4	64.8	3.3
1972	296.7	36.1	91.3	8.0
1973	307.5	38.7	111.7	7.2
1974	266.4	37.0	88.3	9.2
1975	286.4	41.2	103.4	15.9
1976	370.0	47.0	155.7	43.4
1977	368.1	47.1	166.5	58.7
1978	373.5	47.5	117.2	30.6
1979	404.6	51.0	124.9	24.4

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table D-4.--Nonrubber footwear: Unit value of total U.S. imports, and imports from Taiwan and Korea, 1958-79

(Per pair)

Year	Unit value		
	Of total U.S. imports	Of imports from Korea	Of imports from Taiwan
1958	1/ $1.63	-	-
1959	1/ 2.82	-	-
1960	1/ 1.94	-	-
1961	1/ 2.58	-	-
1962	1/ 2.27	-	-
1963	1.42	-	-
1964	1.36	-	-
1965	1.35	$0.39	-
1966	1.65	0.38	-
1967	1.68	0.45	$1.06
1968	1.87	0.51	1.31
1969	2.16	0.55	1.32
1970	2.33	0.68	1.53
1971	2.52	0.78	1.84
1972	2.81	0.87	1.69
1973	3.17	1.04	2.34
1974	3.68	1.47	2.55
1975	3.95	1.52	3.32
1976	4.34	1.79	3.75
1977	4.49	2.08	3.91
1978	5.51	3.30	5.60
1979	6.00	3.71	6.83

1/ Estimates from M. Szenberg, et al., op. cit. p. 137.

Source: American Footwear Industries Association, Footwear Manual, various years.